Gas Journal

SEPTEMBER 12, 1934

Vol. 207. 86th Year No. 3721

Editorial Notes

The North British Meeting

Once more a North British autumn meeting has come and gone—a delightful mixture of business and pleasure amid wonderful surroundings, but with the pleasure always very properly subservient to the more serious matters. Indeed, with such perfect surroundings, as well as the freedom of an excellent golf course for the duration of the meeting, the hundred per cent. attendances at the business sessions were a testimony alike to the popularity of the President, Mr. Lewis Bain, the interest of the Papers, and the keenness of the members for their job.

To those of us who travelled from the South, Inverness seemed to be an infinite distance even beyond parts of Scotland which we had previously regarded as far North, and the organization of a big gathering there must at first have appeared something of a problem even to the President and Secretary of "the N.B." Appreciation of their efforts, which must have been considerable, was evident in the enjoyment of all who took part in the gathering, and their public acknowledgment of the very great assistance rendered by Mr. A. Thomson in making the arrangements gave the members an opportunity of including the local Chief in their expressions of gratitude.

If we may be permitted one comment on the proceedings, it is that the reading in full of three Papers, at any rate of the length of this year's contributions, occupies an undue amount of time, and makes it difficult for the authors to do full justice to the reading of them, or the members to the discussions. Would it be possible for the Papers to be distributed in advance, and then introduced by the authors at the meeting in short summaries?

Multi-Part Tariffs

The paper by Mr. Alexander Jamieson is full of useful hints on the efficient running of a gas-works, and also touches upon several questions of general policy which are exercising the minds of gas administrators throughout the country. Regarding the latter questions, two items are of particular importance—the adoption of scales of charges other than the flat rate, and the standardization of the quality of gas supplied. Many undertakings imbued with the spirit of enterprise have had two-part or other forms of tariffs in operation for some time, and the proved success of this plan should have encouraged all undertakings to go ahead with similar schemes. It is surprising and most unfortunate that the development of attractive price scales is not proceeding more rapidly. A low commodity charge is of great appeal to the consuming public, and the service charge—a known quantity which is budgeted for—is quickly forgotten.

We feel convinced that the electricians owe much of their business to multi-part rate systems. Current at a penny or a halfpenny a unit may not be a true bill, but the consumer knows perfectly well that with a multi-part tariff any additional apparatus which he installs will be provided with current at such low prices. We must get rid of the flat-rate complex, and we must also exploit the selling of gas at different prices at different periods of the twenty-four hours. Reference to this was made in these columns last week, when we called attention to an ingenious meter which makes the rendering of accounts a simple matter.

Mr. Jamieson asks the National Gas Council for a strong lead on the question of rate making. We believe that more could be done, but not so much in the way of a "strong lead." Conditions vary so greatly in different areas that dogmatism would be quite out of place. What might suit one undertaking might be a ruinous policy for another undertaking. We do not want a "strong lead," but we do require a great deal more advice. In this respect, as in certain other directions, we could to advantage take a leaf out of the notebook of the American Gas Industry. In the United States special permanent committees deal with rate structure, and the advice of expert accountants is available to any undertaking. These experts visit the areas of individual undertakings, study the local conditions, and suggest appropriate schemes. We are not for one moment suggesting that the National Gas Council has not paid attention to the all-important matter of pricing. It has done a vast amount of work on the question, and has formulated several schemes after very close study. But we think that something on the lines of the American Gas Industry might be followed here. Rate making is a highly complicated business demanding expert knowledge, and, as we have said, a system applicable to one district might be wrong for another. Mr. Jamieson speaks of "scientific" price scales. We think the word "expedient" is far more appropriate to the matter under discussion. At Johnstone he has a block system of charges in operation, but the first reduction in price does not take place until the consumer has used 80,000 c.ft. per annum. We should like to know what effect this scale has in the direction of attracting new business. To our mind the relief is too long delayed. On the other

hand, Mr. Jamieson sells cheap gas, and the first block is charged at only 6·9d. per therm to the ordinary consumer, the prepayment consumer being charged an additional penny.

Standard Gas

THE other question to which we have referred is that of the standardization of gas quality. There can be little doubt that theoretically this is an ideal, but we have to keep constantly before us the making of the cheapest therm. Coals vary in quality, local conditions vary, the markets for residuals vary, and different types of plant are employed by different undertakings. General policies are also at variance—to a degree which some find difficult to explain. In spite of all these considerations, however, it does seem that there are unnecessarily wide variations in declared calorific values. We have in mind undertakings which to all intents and purposes are operating under similar conditions to others the areas of which they adjoin, and yet there are wide divergences in the calorific values of the gas supplied—variations which cannot be explained away by differences in the coke market.

Now we are well aware that, given a supply of gas which does not vary in composition and specific gravity, and which is supplied at adequate and uniform pressure, the actual heat content in a cubic foot is no measure of its performance in the appliance. We take it for granted, of course, that the appliance is properly adjusted to give maximum service. The " snag " lies in the adjustment. Mr. Jamieson points to the fact that at Johnstone—and what applies there is almost generally applicable—apparatus is in use which is manufactured in London, Birmingham, Leeds, Warrington, Manchester, and Falkirk, and tested on gas with calorific values of 560, 500, 475, 470, 450, and 430 B.Th.U. These appliances are used in Johnstone with gas at 420 B.Th.U. " It is," remarks Mr. Jamieson, " highly creditable to the design and flexibility of this apparatus that high efficiencies are possible under such unfavourable conditions. It is only by the use of gas and air regulators, however, that the difficulties have been overcome, and so long as such regulation is necessary, and so long as these adjustments are left largely to the non-technical consumer, the maximum efficiency of utilization will not be attained." We thoroughly agree. This is obvious enough from the operation of the ordinary lighting burner complete with gas and air adjustment. And what happens to the lighting burner is occurring perhaps less noticeably in the other appliances installed on the premises. We should like to see the departure of the gas and air adjuster, and we do not think it is beyond the bounds of practical politics. We cannot visualize at the moment a standardized gas supply throughout Great Britain, but there appears good reason for advocating, as we have already in these columns, a limited number of declared values—and this number need not be great. Then we could have a small series of scientifically designed fixed nipples. Their use on the district would undoubtedly enhance gas service. It might impose more rigorous control of gas quality at the works end, but this would be all to the good.

Flexible Gas-Making

WE have mentioned that Mr Jamieson sells cheap gas. We do not think for a moment that he concentrates solely on " manufacture," but we do believe he makes " profits in the retort house." A considerable portion of his contribution to the proceedings of the North British Association is concerned with gas-works practice at Johnstone, and we are impressed once again with the fact that efficiency of gas production is not the sole prerogative of the large undertaking. This fact contributes in no small measure to the strength of the Gas Industry. The carbonizing plant at Johnstone consists of eight 50-in. " New Model " Glover-West vertical retorts of an aggregate nominal capacity of 800,000 c.ft. of 420 B.Th.U. gas per day. The entire plant can be operated by one man, though at Johnstone two men are employed—as a precautionary measure, we gather. It might be thought that with a small number of large retorts the flexibility of the plant to meet the wide fluctuations in output would be limited, but Mr. Jamieson demonstrates by a very interesting chart the wide range over which it is possible to vary the production of gas without materially affecting the efficiency of the plant. The continuous vertical retort has proved itself a " type of plant suitable for any size of works." We quote Mr. Jamieson. But the very flexibility of such plant—the ease of adjustment of the variable factors, speed of extraction, combustion flue temperatures, and amount of steaming—may lead to loss of efficiency unless due care is paid to the quality of the coal or coals carbonized, and observations are made to ensure that the variables are correctly adjusted to the class of coal put through the retort. In this regard the author has much useful information to impart, and his remarks on producer working are very much to the point. By strict daily supervision of the producer plant he has been able to realize a reduction in fuel consumption of as much as 10%.

Finally, we would call attention to Mr. Jamieson's record of the maintenance costs of the carbonizing plant. The entire plant has now been in operation for nearly four years, during which some 24,500 tons of coal have been carbonized; and all the repairs have been minor ones. " The retorts are at present showing very little sign of wear, and no leaks of any consequence have appeared." From observation it would seem that the refractory material is still in every way sound and should be good enough to stand for a further long period of service. The total cost of repairs on the entire plant has been £423, which gives an average maintenance charge on the plant of 4·148d. per ton of coal carbonized. A figure of 4·5d. per ton was given by Mr. T. Campbell Finlayson (" JOURNAL " for Jan. 17, 1934) for maintenance charges for plants using Scotch coals.

Distribution and Amalgamation

NEVER does the Press of the country fail to find matter of interest to readers in the contributions submitted at annual meetings of the British Association, and last week's gathering at Aberdeen has provided much good reading in the daily newspapers. From time to time at these meetings, too, subjects are discussed which have particular bearing upon the problems of our own Industry, and this year affords an outstanding example in that respect in the form of a constructive paper dealing with a problem which is largely in the minds of all of us. Among the factors which weigh in the balance for or against amalgamation, considerations affecting distribution must occupy an all-important place, and these are usefully elaborated in the British Association paper by Dr. C. H. Lander and Dr. E. W. Smith, the main portions of which are reproduced on later pages of this issue. We see how different are the factors which govern the economic distribution of gas and electricity, and then we have explained to us three representative schemes in which large quantities of gas are conveyed from the

point of manufacture to some other point where the gas can be introduced into the street mains.

Illustrating a scheme for transferring bulk quantities of gas from one manufacturing station to another or to a gasholder station, the Gas Light and Coke Company is cited. This Company is itself, as readers are well aware, an amalgamation of a large number of gas undertakings, and a policy has been followed such as would be likely to commend itself in similar circumstances elsewhere—that is to say, as the area of the Company developed by the absorption of other undertakings, a process of selection of manufacturing stations was commenced, some being retained in operation and others closed down. Birmingham is quoted as an example of a scheme for transferring quantities of gas from a manufacturing station to the more remote parts of the area of supply, where the gas is introduced into the ordinary mains through governors, and, thirdly, there is the Sheffield gas grid, by means of which big quantities of coke oven gas are transferred to the Gas Company.

Before passing on, mention may be made of the coke oven gas statistics quoted. In refutation of any assertion that the Gas Industry in England has been backward in making use of the supplies of surplus coke oven gas which are available, the authors point to the fact that already 34 gas undertakings are receiving part or all of the gas they sell from coke oven plants, and of these undertakings no fewer than 20 receive the whole of their requirements from coke ovens. At the present time the quantity of gas bought by gas undertakings from coke oven plants amounts to upwards of 15,000 million c.ft. per annum, and a considerable increase on this figure in the near future is confidently anticipated. At the moment additional coking plants are being connected up with the Sheffield mains.

National Development Necessary

In the first number of the "JOURNAL" issued during August, a correspondent, referring to Holding Companies and the Gas Industry, after remarking that the consumers are, or should be, the first consideration of every gas undertaking, went on to say that in the case of the South-Eastern Gas Corporation economies in working have already brought about reductions in the price of gas in three of the Companies under its control; and this brings us to the heart of the paper by Dr. Smith and Dr. Lander—which is that the primary concern of the Gas Industry should be to produce cheap gas, and that such aggregations of gas undertakings as we have witnessed lately "will prove of national importance just in so far as the facilities provided are used to the greatest advantage." As the most important factor governing the cost of gas to the consumer is that of distribution, the authors say it is all the more important that gas undertakings should not continue to be run as individual entities completely dissociated from one another. But at the same time they would obviously like to see a co-ordinated policy followed in this respect, for they feel that the Industry is of such national importance that it should not continue to develop on haphazard lines, "with the main incentive for major changes coming from outside financial interests."

The way to development in a national direction is indicated in the paper, and we feel sure the authors will not be inclined to leave the matter without its being further ventilated. Several bodies are suggested to further study the subject, but our own preference would be—in the first place, at all events—for a Committee of the Gas Industry, rather than a Government Department or a Committee of the British Association. Three districts are indicated as being suitable for development along the lines of further co-ordination of manufacture and distribution, which would require the transport of coke and gas over distances substantially the same as in the case of the existing distribution systems referred to earlier in the paper. These districts are respectively round London and Birmingham and in Lancashire, and the authors see no reason why the Industry itself, if given sufficient powers, should not develop a national scheme, probably dividing the country up into convenient zones, five or six in number, each of which should be under the broad control of a centralized authority, and all of whom would be linked up with some national body. There should be some means of overcoming the difficulties—referred to by the authors as "almost insuperable"—of bringing about financial and engineering co-operation between municipalities and others; if not, the proposal would seem to be unworkable, as the municipally owned undertakings are intermingled with those under company control. This, therefore, is one of the first matters that would have to be settled by any body appointed to discuss a national scheme of this character.

The paper is an opportune one, for, as we have already said, it deals with a matter which is in the minds of all of us. No more suitable opportunity than the present is likely to arise for full discussion of the proposals put forward by the authors.

A Word of Warning

REFERENCE to developments in the use of compressed coal gas for road traction purposes is made in the Fifty-Eighth Annual Report of H.M. Inspectors of Explosives for the year 1933 (H.M. Stationery Office; price 1s.), in which connection a word of warning is very rightly issued on the subject of gas propulsion of motor vehicles. The Report points out that such progress as has been made up to the present has been the result of methodical and painstaking experimental work. The results, it may be claimed, have met with great success; but this does not mean that, in spite of the issue of Controlling Regulations, all difficulties have been overcome. The continued use of compressors and vehicle equipment bring to light fresh difficulties which can only be met by the skill and experience of the expert. The project, it is hoped, will continue to develop on sound lines, and those considering the adoption of gas propulsion must be prepared to provide skilled staff for the supervision and "servicing" of the compressors and vehicle equipment.

As regards such few gas-filling stations as at present exist, it has not yet been found necessary to require additional control to that provided by the Factory and Workshop Act, but already application has been received, from two of the larger industrial bodies interested in the project, that serious consideration should be given by the authorities to the making of regulations for gas-filling stations in order to safeguard users and the public against accidents. At present the filling stations are in the hands of those thoroughly acquainted with the equipment, but if or when gas propulsion becomes more general and when gas-compressing plant may become a natural addition to many of the larger roadside petrol stations, the provision of further regulations will, no doubt, be considered necessary, and powers may require to be taken under the Petroleum (Consolidation) Act, 1928. It may, perhaps, be mentioned here that to control the use of the cylinders on the road, provisional regulations were issued on July 12, 1933, under the title of the Compressed Gas Cylinders (Fuel for Motor

Vehicles) Provisional Regulations to control cylinders and valves used for containing gas at higher than normal pressures in cylinders fitted to motor vehicles. The Motor Vehicle (Compressed Gas Propulsion) Provisional Regulations, 1933, were made simultaneously by the Minister of Transport.

Safety Measures

THE Report also refers to some practical experiments carried out at Shoeburyness, which have an important bearing upon the general safety of cylinders used for gas propulsion. Two cylinders (one from each of two firms) fully charged with gas were placed over a rectangular tank containing wood and 100 gallons of petrol and lighted from a distance. In each case an interval of over four minutes elapsed before the cylinder burst. The cylinders were purposely not fitted with safety devices, which are compulsory in practice. Thus, under the worst conditions, a considerable interval of time could be expected to elapse before a cylinder burst. In practice the safety vent provided by the bursting disc or fusible plug is designed to prevent the possibility of cylinders bursting, if involved, for instance, in a garage fire, or an accident on the road resulting in the conflagration of the vehicle—a very important consideration, particularly if gas be used for the propulsion of public service vehicles.

Attention is also drawn in the Report to another proposed use for high-tensile alloy steel cylinders—namely, for taking town gas to outlying villages beyond the immediate reach of gas mains. This system is in operation in America and Denmark, an article dealing with its application in the latter country having appeared in the "JOURNAL" for Nov. 22, 1933. In such instances gas is supplied to the house from a cylinder placed in an external cubicle, and lorries call at intervals to exchange filled for empty cylinders. As the saving of weight is not so important as in the case of gas propulsion cylinders, and as loose cylinders will receive more handling and rougher usage, a rather larger factor of safety is considered desirable, and consequently thicker walled cylinders are required.

On the other hand, if cylinders are to be used in the form of "batteries" secured to lorries or trailers and charged and discharged as a single unit, those of the gas propulsion pattern might be used if suitable conditions can be assured. Arrangements are being made to manufacture sample alloy steel cylinders having a factor of safety of about 3 for examination by the N.P.L.

As we have pointed out before, and as is further borne out by Dr. E. W. Smith in the course of his reply to the discussion on his and Dr. Lander's recent paper before the British Association at Aberdeen, the supply of gas in cylinders at pressures up to 5,000 lbs. for use in outlying districts, beyond the immediate extent of any gas mains, merits the serious consideration of the Industry. It is even possible for the larger undertakings to send cylinders of gas for delivery into holders for serving such outlying villages. In any case the supply of gas in cylinders for domestic use is to many undertakings a more practical—and profitable—consideration for the present than that of vehicle propulsion, whose sphere of use is generally limited to the more urban areas. Once the country house, however, is properly carcassed and is regularly using gas for all domestic purposes from the storage cylinder or district holder, it will not be so difficult a matter to combat electrical competition, while it will be simplicity itself to connect up the outlying district thus supplied to the usual gas mains when it is found practicable to extend them to the area.

Art in Advertising

SOME weeks ago, when referring to the power of good advertising, we invited readers to compare the advertisement pages of present issues of the "JOURNAL" with those of fifty, or even ten, years ago, and so convince themselves of the immense strides that have been made meanwhile in attractiveness. Whether in person or in print, attractiveness makes the first appeal, but while in both cases this quality may owe itself to various causes, one would be inclined in the former to put personality first, and in the latter to give pride of place to beauty.

Since this former reference of ours was penned, we have been heartened by reading in the *Daily Mirror* an article by Mr. Raymond Rutherford on "Art for Business' Sake." That article, though it is mainly devoted to discussing posters—a branch of publicity which offers enormous scope for improvement—points to the advantages of attractiveness as applied to advertising in general. Good as is the work of the advertisement expert at present (as witness the "JOURNAL" announcements), still better may be confidently predicted for the future. Mr. Rutherford, indeed, goes so far as to assert that "the future of art, with certain rare exceptions, is in the service of business. . . . As more and more business men follow the example of the petrol people, and learn that good art is the finest salesman they can employ, there are bound to be increasing opportunities for good work in the service of industry. . . . An immense amount of pleasure awaits the public as good art becomes an increasingly widespread factor in business advertising."

With views such as these in mind—views with which we find ourselves thoroughly in accord—the advertisement pages of the "JOURNAL" will be scanned with ever-increasing eagerness as time passes.

Forthcoming Engagements.

Sept. 17-20.—ASSOCIATION OF PUBLIC LIGHTING ENGINEERS.—Eleventh Annual Meeting at Aberdeen.
Sept. 20.—I.G.E.—Refractory Materials Joint Sub-Committee (Stoke-on-Trent), 2.30 p.m.
Sept. 20.—WALES AND MONMOUTHSHIRE ASSOCIATION.—General Meeting at Porthcawl.
Sept. 20.—THE CERAMIC SOCIETY.—Autumn Meetings of the Refractory Materials and Buildings Materials Sections at Olympia, London.
Sept. 24-26.—B.C.G.A.—Annual General Meeting and Conference at Sheffield.
Sept. 25.—S.B.G.I.—Meeting of Council, Royal Victoria Station Hotel, 4.45 p.m.
Sept. 27.—I.G.E.—Liquor Effluents and Ammonia Sub-Committee, 2.30 p.m.
Sept. 28.—I.G.E.—Joint Research Committee, 10.30 a.m.; General Research Committee, 2.30 p.m.
Oct. 5.—NORTH OF ENGLAND ASSOCIATION.—Autumn Meeting. Presidential Address of R. H. Duxbury, of South Bank, and visit to I.C.I. works at Billingham.
Oct. 5.—B.C.G.A.—South-Western District Conference at Ilfracombe.
Oct. 17.—B.C.G.A.—Executive Committee, in the Board Room, 28, Grosvenor Gardens, S.W. 1, at 12 noon.
Oct. 26.—B.C.G.A.—Scottish Conference at Dundee.
Nov. 6 and 7.—I.G.E.—Autumn Research Meeting.
Nov. 8.—S.B.G.I.—Autumn General Meeting, Hotel Metropole, London.

1934 "JOURNAL" Directory.

Page 10. BRADFORD. G. E. Currier appointed E. & M. vice E. Crowther.
Page 20. DARWEN. T. Haworth appointed E. & M. vice A. F. Ames.
Page 56. RIPON. T. Haworth, E., M., & S. resigned.
Page 62. SITTINGBOURNE. A. P. Ghent, S., resigned.

PERSONAL

BRADFORD'S NEW ENGINEER.

Mr. GEORGE ERNEST CURRIER, Deputy Gas Engineer to the Bradford Corporation, was, on Sept. 7, unanimously recommended by the Gas Committee for appointment as City Gas Engineer and General Manager, in succession to Mr. Edward Crowther, lately appointed to the Salford Gas Managership. The salary commences at £1,000 per year, rising to £1,500. Mr. Currier, a native of Birmingham, where he received his early training, was four years Chief Assistant at the Smethwick Corporation Gas-Works, and was closely associated with a £200,000 reconstruction scheme there. At the time he went to Bradford as Deputy-Engineer, two and a half years ago (selected out of 72 applicants), he was Works Manager at the Meadow Lane Gas-Works of the Leeds Corporation. He has been an active member of the Yorkshire Junior Gas Association since going into Yorkshire.

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APPOINTMENT AT DARWEN.

Mr. THOMAS HAWORTH, Engineer, Manager, and Secretary of the Ripon Gas Department, has been appointed Engineer and Manager of the Darwen Corporation Gas Undertaking in succession to Mr. A. F. Ames, who, as announced recently in these columns, has been appointed to the Managership at Burnley. Mr. Haworth, who has been at Ripon for over six years, was previously assistant to Mr. Ames at Oswaldtwistle. There were four applicants for the position, which carries a salary of £600 per year, rising in four years to £700. An old boy of the Oswaldtwistle and Accrington Technical Schools, Mr. Haworth also studied at Blackburn Technical College nearly three years. For four years he was an analytical and chemical engineer with Messrs. F. Steiner & Co., calico print manufacturers, of Church.

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Mr. A. P. GHENT, the Secretary and Accountant to the Sittingbourne District Gas Company, who a short time ago was also appointed Secretary to the Dover Gas Company and the Deal and Walmer Gas Company, will, it is understood, shortly be terminating his appointment at Sittingbourne in order to extend his activities with other undertakings controlled by the South-Eastern Gas Corporation. Mr. Ghent went to Sittingbourne in 1915. His services on behalf of the Sittingbourne Gas Company have at all times been highly appreciated, and it is not too much to say that the success of the Company was in no small measure attributable to his wise counsel and business capacity.

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Mr. ROBERT WATSON, Gas Engineer and General Manager to the Doncaster Corporation, who retires on superannuation at the end of September, was the subject of warm tributes at a Doncaster Town Council meeting last week. Alderman W. J. Crookes, Chairman of the Gas Committee, said Mr. Watson had been at Doncaster 32 years, and he (the speaker) had had 14 years' happy association with him. During Mr. Watson's period the local gas service had increased from 30 miles of mains to 126 miles, and the output of gas from 180 million c.ft. per annum to over 580 millions. Many big extension schemes had been brought to successful fruition under his guidance. Alderman S. Morris (Deputy-Chairman) added tribute as one who had been associated with the retiring Engineer for 22 years; and other speakers were the Mayor (Councillor G. H. Ranyard), Councillor Warren, and the Town Clerk, the latter speaking on behalf of Mr. Watson's fellow public officials. Mr. Watson, in reply, thanked the Council and members of the Gas Committee for their warm support and friendship, and paid high tribute to the comradeship and good work of his departmental staff and workmen.

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At a meeting of Motherwell and Wishaw Town Council last week, approval was given to the appointment of Mr. WILLIAM KIRK, formerly Chief Technical Assistant, to the post of Assistant Gas Manager in succession to Mr. James Leckie, who has been appointed to Windermere. Mr. DAVID GARDNER'S appointment to the post vacated by Mr. Kirk was also approved. Mr. Gardner comes from Alloa.

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Mr. L. R. PARKINSON, B.A., who was recently appointed to a staff position with Messrs. W. Parkinson & Co., of Stechford, Birmingham, was presented on the occasion of his marriage with an oak bureau subscribed for by members of the staff and also the staff of the Parkinson Stove Company.

Annual Conference of the B.C.G.A.

The following programme has been arranged for the Annual Conference of the British Commercial Gas Association to be held in Sheffield under the Presidency of Lieut.-Colonel H. K. Stephenson, D.S.O., D.L., LL.D., J.P.:

Monday, Sept. 24.

8. 0 p.m. Reception of Conference Delegates at the Town Hall by the Lord Mayor of Sheffield and Sheffield City Council, followed by a Dance.

Tuesday, Sept. 25.

MORNING (MEMORIAL HALL).

10.30 a.m. Annual General Meeting.
Presentation of Annual Report and Accounts.
Presidential Address by Lieut.-Col. H. K. Stephenson, D.S.O., D.L., LL.D., J.P., President of the Association.
Presentation of Report of the Institution of Gas Engineers on "Methods for the Development of the Use of Gas for Domestic Purposes," by Mr. C. Valon Bennett, President Inst.Gas E., First Vice-President of the Association.
Paper by Mr. W. D. Rowe, Manager of the British Commercial Gas Association, entitled "Co-Operation of All Arms," followed by Mrs. Eileen Murphy on "Home Service," and Discussion.

AFTERNOON (MEMORIAL HALL).

2. 0 p.m. Paper by Mr. Ralph Halkett, General Manager and Secretary of the Sheffield Gas Company, entitled "Gas Service in Sheffield," followed by Discussion.
Visits to—(*a*) Industrial Research Laboratories; (*b*) The Control Room of the Sheffield Gas Company.

EVENING (THE CUTLERS' HALL).

7.15 p.m. for 7.45 p.m. Annual dinner to the Delegates, who will be the guests of the Chairman and Directors of the Sheffield Gas Company.

Wednesday, Sept. 26.

MORNING (MEMORIAL HALL).

10.30 a.m. Address by the Rt. Hon. J. R. Clynes, P.C., J.P., entitled "Labour and the Gas Industry."
Paper by Mr. John Terrace, M.Inst Gas E., entitled "Education in the Gas Industry," followed by Discussion.
Close of Conference.
Luncheon in the Royal Victoria Hotel by the President and Members of the Association to the retiring President and the Directors of the Sheffield Gas Company.

Gas Meter Testing in Glasgow.

Annual Report.

The total number of gas meters tested during the year ended May 31, 1934, by the Glasgow Gas Meter Testing Department, was 35,576, and the amount of fees collected was £2,414. These figures are an increase on those of 1933. Of the total number of meters tested 19,098 were new meters, 16,057 were repaired meters, and 421 were sent in by gas consumers for certification as to correctness.

Summary of Results of Testing.

New Meters.		Repaired Meters.		Meters sent by Consumers for Certification.	
Correct and Stamped.	Rejected.	Correct and Stamped.	Rejected.	Correct and Stamped.	Rejected.
18,904 99%	194 1%	15,658 97·5%	399 2·5%	104 24·7%	317 75·3%

Analysis of Faults and Errors.

Nature of Fault.	New Meters.	Repaired Meters.	Meters Sent by Consumers for Certification.
Fast in registration	101	146	195
Slow in registration	39	127	38
Passing gas but not registering	11	20	1
Ceased to register (bound)	7	10	1
Leakage	8	10	2
Passing unregistered gas	3	10	3
Drawing lights (oscillation)	12	37	67
Excessive absorption of pressure	3	26	..
Other faults	10	13	10
	194	399	317

News In Brief

South-Eastern Gas Dividends.—The Directors of South-Eastern Gas Corporation, Ltd., have declared an interim dividend on the ordinary shares of 3% actual (less tax), payable on Oct. 1, 1934.

Floodlighting of Aberdeen.—Gas, as well as electricity, was freely used in connection with the floodlighting of Aberdeen from Sept. 5 to 12 in honour of the visit to the city of the British Association.

The Output of Gas by the Doncaster Corporation Undertaking for the month of July showed an increase of a million and a half cubic feet over the corresponding month last year. The actual output was 39,113,000 c.ft.

A Special Order under the Gas Undertakings Acts, 1920 and 1929, is being applied for by the Leeds Corporation with a view to extending the limits within which the Corporation are authorized to supply gas, and for other purposes.

The Latest Gas Appliances will be exhibited on the stand of the Edinburgh Gas Department at the Workers' Trades and Crafts Exhibition, arranged by the Edinburgh and District Trades and Labour Council, to be held in Edinburgh in January.

Hastings and St. Leonards Gas Company are paying interim dividends (less income-tax) at the following rates: £7% per annum on the 5% converted stock; £5 10s.% per annum on the 3½% converted stock; and £6 8s.% per annum on the 5% additional stock.

At Taunton Carnival on Saturday, Sept. 1, when competition was so keen that extra prizes had to be awarded, the Taunton Gas Company won first prize in the class for the best group (other than comic) on foot and third prize in the class for the best trade turnout.

Coke Oven Managers' Association.—The Annual General Meeting and Dinner will take place at the Hotel Victoria, Northumberland Avenue, London, on Thursday, Oct. 25. On Friday, Oct. 26, a visit will be paid to the Ford Motor Company's coke oven plant at Dagenham.

Application is Made to the Board of Trade by the Ormskirk District Gas Company for a Special Order under Section 1 of the Gas Undertaking Act, 1929, to authorize the Company to borrow on mortgage of their Undertaking or by the creation or issue of debenture stock, and for other purposes.

Imports of Gas Mantles into Holland.—During the six months ended with June last 384,000 incandescent gas mantles, valued at £9,600, were imported into Holland, as compared with 364,000 in the first half of 1933. The bulk of the imports, 293,000 mantles, is credited to Germany, followed by Great Britain with 68,000 and Sweden with 20,000.

Cookery Demonstrations in a Travelling Showroom were given last week at Stonehaven under the auspices of Stonehaven Gas Company. The opening ceremony was performed by Mr. Charles George, Milbirnie. The exhibition is being supervised by Mr. W. J. Crawford, of Messrs. R. & A. Main, Ltd., Falkirk, and will remain open till Sept. 14.

The Under-Secretary of State for Air, the Rt. Hon. Sir Philip Sassoon, Bart., G.B.E., C.M.G., paid an informal visit to the works of the Folkestone Gas and Coke Company on Wednesday, Aug. 29. While making a tour of the works, Sir Philip spent some time inspecting the benzole plant, and expressed his interest in the home production of motor spirit.

During the Month of July 14,938 tons of coal, valued at £14,169, were imported into the Irish Free State for gas-making purposes, as against 12,800 tons, valued at £13,031, for the corresponding month of 1933. This makes a total for the seven months to July of 112,394 tons, valued at £118,811, as compared with 135,920 tons, valued at £136,945, for the first seven months of last year.

New Members of the Bribery and Secret Commissions Prevention League, as announced in their last *News-Sheet*, include the following: Ashmore, Benson, Pease, & Co., Ltd., Parkfield Works, Stockton-on-Tees; John J. Baines, Director of Clayton, Son, & Co., Ltd., Moor End Works, Hunslet; Robert Dempster & Sons, Ltd., Rose Mount Iron Works, Elland, Yorks.; the Herne Bay Gas Company, Ltd.; Newton, Chambers, & Co., Ltd., Thorncliffe Iron Works, near Sheffield; and the Whessoe Foundry and Engineering Company, Ltd., Darlington.

The Minister of Health has sanctioned the borrowing by the Doncaster Corporation of £8,400 for the provision of four purifiers at their Gas-Works.

The Directors of Radiation, Ltd., have declared an interim dividend on the ordinary shares of 7½d. per share (3⅛% actual), less tax, and an interim dividend on the 6% cumulative preference shares of 3% actual, less tax, for the half-year ended June 30, 1934. Dividend warrants for both classes of shares will be posted on Oct. 13, 1934. The transfer books for both classes of shares will be closed from Sept. 10 to 22, both days inclusive.

The Autumn Meetings of the Refractory Materials and Building Materials Sections of the Ceramic Society will be held during the Building Trades Exhibition at Olympia, London, on Thursday, Sept. 20. In the evening at 7.30 for 8 p.m., the Society's Banquet will be held at the Grosvenor Hotel, Park Lane, W. 1. This will be followed by dancing and cabaret in the restaurant. Ladies are particularly invited to this function.

Copies of the Recently Published British Standard Specification for Nickel Ammonium Sulphate and Nickel Sulphate for Electroplating (No. 564-1934) may be obtained, price 2s. each, from the Secretary of the Institution of Gas Engineers, 28, Grosvenor Gardens, S.W. 1. Also, copies of the recently published British Standard Engineering Symbols and Abbreviations (No. 560-1934) may be purchased at the same address for 3s. 6d. each.

The Wales and Monmouthshire Association will hold their General Meeting at Porthcawl on Sept. 20, under the Presidency of Mr. I. G. Jenkins. After the usual business, including the introduction of the President-Elect (Mr. H. Barker), a paper will be read by Mr. W. D. Rowe on the Aims and Objects of the B.C.G.A. There will be a luncheon at the Esplanade Hotel, while on Sept. 19 the Golf Cup is to be played for on the links of the Royal Porthcawl Club, after which the usual dinner will take place at the Esplanade Hotel.

International Consumption of Road Tar.—According to *Die Chemische Industrie*, the quantity of refined tar used for road purposes in Germany last year was 158,000 tons, or about 15% of the total output. In regard to Switzerland, the consumption last year was 40,000 tons, or 59% of the total output. French road tar utilization in 1933 totalled 550,000 tons, or 96% of the domestic production. In America road tar consumption last year was about 600,000 tons, probably about 30% of the total make. In Great Britain last year's road tar consumption figure was 875,000 tons, or about 70% of the domestic output. In 1929, 42% of the British tar output was used for road purposes. Italy consumed about 15,000 tons of road tar last year.

A Plea for "The Light that Never Fails" was put forward at a Ministerial Inquiry at Wood Green last week, when the Borough Council sought sanction to a loan of £3,370 for the electric lighting of three main roads. It was pointed out that four members of the Corporation were in favour of adopting high-pressure gas lighting, and objection was also made against the peculiar colour of the new type of electric lighting. Councillor J. Burr contended that the cost of installing and maintaining gas was much lower than electricity. In one road the cost of installing gas was £541, against £817 for electricity. There was also the sum of £468 for removing the present gas columns, which the Gas Company would have been prepared to do for nothing. The Ministry's decision will be announced shortly.

General Notification of the Gas Referees.—From Oct. 1, 1934, in accordance with the Gas Undertakings Acts of 1920 and 1934, previous issues of and Supplements to the General Notification of the Gas Referees except in so far as they are recited as current in the Re-Issue of Aug. 31, 1934, will cease to be current for any Undertakers for whom Special Prescriptions incorporating the General Notification and Supplements have been issued, and will be superseded for those Undertakers by the present issue as from that date. Returns and Reports for the quarter ended Sept. 30, 1934, however, will be made and applied in accordance with the Special Prescriptions and General Notification (and Supplements thereof) current for that quarter. The Re-Issue of the General Notification of Aug. 31, 1934, will remain current, subject to modifications introduced in any Supplement, until superseded by a later Re-Issue.

Record Month at Croydon.—It is pleasing to note that the output of the Croydon Gas Company for the past month of August was the highest on record for that particular month. The Company sent out 196,592,000 c.ft. of gas, which represents an increase of 6·41% over the corresponding month last year. The Company are steadily increasing their load for water heating. Making due allowance for climatic conditions, the Croydon Gas Company are certainly to be congratulated upon the figures quoted.

Waterless Holders for South Wales.—Messrs. Horseley Bridge & Thomas Piggott, Ltd., who recently completed a 2 million waterless holder (Klönne Patents) for the storage of blast furnace gas at the Port Talbot Works of the British (Guest Keen Baldwins) Iron and Steel Company, Ltd., have just received a repeat order for the Company's new steel works at Cardiff. The present contract comprises two waterless holders, one of 3 million c.ft. capacity for the storage of blast furnace gas and one of 1 million c.ft. capacity for coke oven gas. Each holder will be equipped with an internal electric lift, and an external lift will be erected between the two holders with connections to the galleries of each.

The Sir John Cass Technical Institute.

Opening of the New Wing.

The new wing of the Sir John Cass Technical Institute is now completed and will be opened by the Rt. Hon. the Earl of Athlone, K.G., on Oct. 10. The extension of the Institute building has been made possible by the governing body who acquired a long Corporation of London lease of 2,000 years of the properties immediately adjoining the existing building on the north. The site, which is approximately 5,000 sq. ft., has allowed the frontage of the Institute to be extended by about 75 ft.

The extension, designed by Mr. Verner O. Rees, F.R.I.B.A., comprises a large hall and stage, a refectory and kitchen, a staff common room, three large art rooms, and additional laboratories and lecture rooms for metallurgy, physics, organic and bio-chemistry.

The Institute, among other subjects, provides instruction in pure and applied mathematics, physics, chemistry, botany, fuel technology (including carbonization and gas manufacture), and metallurgy.

Bottled Gas Solves the Problem.

Abertillery's Enterprise.

The recent outing of the Blaenau Gwent Baptist Sunday School to Crickhowell was the occasion of a practical demonstration of the value of bottled gas when the organizers were faced with the problem of providing tea for a party of over six hundred and fifty persons remote from any gas supply. One of those responsible for the success of the outing approached Mr. H. Maycock, Engineer and Manager of the Abertillery Gas Department, and put the question before him.

An adequate supply of boiling water was available throughout the whole of the day's festivities, thanks to the gas supplied by the Abertillery Undertaking in steel cylinders loaned by Dr. Walters, of the Birmingham Gas Department, together with the necessary reducing valve, pressure gauge, and key. The boilers and other equipment were provided by the Abertillery Undertaking, and advantage was taken of the interest aroused by the success of the venture to book orders for domestic appliances. At the conclusion of the day's enjoyment the Church Council expressed their gratitude to the Engineer for his enterprise.

Gas Supply in Paris.

Consumers Pass the Million Mark.

From a first glance of the recently-issued Annual Report for 1933 of the Société du Gaz de Paris it would appear that there has been a heavy decline in output during the past twelve months, the total production of 19,077,265,000 c.ft. comparing with 19,353,997,000 c.ft. in 1932.

It is pointed out, however, that the latter was a leap year and consequently had an extra working day. In view of the fact that the average daily output of the various Paris gas-works amounts to over 50 million c.ft., the decline of 276,732,000 c.ft. as between 1933 and 1932 becomes less serious—amounting as it does to only about 1·4%. As against this, too, it is satisfactory to find that the number of consumers again shows an increase—from 980,102 at the end of 1932 to 1,000,136 at the close of the past year. During the twelve months the mains department of the Company laid about 60 miles of new mains, of which the bulk, 45 miles, was renewal work, the actual extension of the distribution system, which now aggregates 1,628 miles, being about 15 miles.

The public street lighting service supplied by the Paris Company is still giving satisfaction, evidence of which is afforded by the fact that the number of normal-pressure burners in use for this purpose increased during the year from 120,479 to 122,289, while the number of inverted multi-burners also advanced from 16,074 to 16,123. An interesting item of the Report is that to provide against darkened streets as the result of the failure of the supply in those thoroughfares which have electric lighting, no fewer than 37,082 emergency gas lights have now been installed, as compared with only 34,214 this time last year. Still another interesting item, in view of the great increase which is taking place in the number of illuminated "safety-first" street refuges in this country, is that the number of such refuges in Paris that are gas-illuminated has been increased during the past year from 354 to 451.

Domestic gas-using appliances continue to make steady progress, and as a result of the continuance of the popularizing campaign, the number of gas-operated refrigerators is steadily increasing—no fewer than 341 having been installed during the past year. Steady progress is also recorded in gas cooking in hotels, restaurants, and other large establishments, as also in pastry-making shops and bakeries.

Numerous additional industrial gas installations were carried out during the year.

Lancashire Coals.*

The publication, by the Department of Scientific and Industrial Research, of the results of an impartial survey of a large number of commercial grades of Lancashire coal, as actually marketed by the collieries, endorses the general high reputation which Lancashire coal has long held.

The work is part of the physical and chemical survey of the national coal resources which is proceeding along two closely related lines—namely, seam sampling and commercial sampling. Since its inception, the survey has been continuously engaged upon a detailed investigation of the seams in the various coalfields, as they exist below ground, with the object of obtaining fundamental data to enable the country's coal resources to be used to best advantage. Many of the seams occurring in the Lancashire coalfield have already been examined in this manner; the data are published from time to time and the work is continuing. The data yielded by this side of the work form the basis necessary for a correct interpretation of the results of the other and more recently instituted investigation, which is concerned with the sampling and analysis of the various grades of coal actually available to consumers.

The report now issued gives the first results of a systematic examination of the numerous commercial grades of coal produced and marketed in Lancashire; 103 grades, the product of 28 collieries, are dealt with.

A wide range of seams is represented in Lancashire and considerable variation in properties occurs, from coals with high-caking qualities and low oxygen content to non-caking coals with high oxygen content. Typical samples of all kinds are included in the report, from those producing high-class metallurgical or foundry coke, through gas coal to poorly coking free-burning coals used for steam raising, with, in addition, many first-class house coals. The sizes range from large house coal to slack.

With the exception of the determination of the caking index (agglutinating value) and of the phosphorus content, the methods of analysis used were those recommended by the British Standards Institution.

The report is arranged under headings, one section being devoted to each colliery. In these sections the grades are enumerated and described. The seams from which they were obtained are listed and details are given of the size, method of preparation for the market, the commercial uses of the grade, and the date of sampling. This is followed by the analytical data, which include proximate analysis, sulphur content, calorific value, and the results of a laboratory carbonization assay carried out at 600° C. in a Gray-King apparatus. In those grades used for coke manufacture, figures are given for the phosphorus content of the coal.

* Fuel Research Survey Paper No. 33. The Lancashire Coalfield. Analysis of Commercial Grades of Coal—Part I. Published by H.M. Stationery Office; price, 1s. 6d. net.

INTERNATIONAL GAS UNION

Second International Conference, Zurich, Sept. 1 to 4

We continue this week our review of the Zurich Conference, including a full report of the only considerable discussion—that upon the British Paper—which ensued during the business sessions. We also give abstracts of the French and Belgian Reports ; those of the German and Swiss Societies having been published last week, as well as the full text of Mr. Clifford Paige's paper (pp. 515-18).

Saturday having been occupied by the meeting of the Swiss Society, Sunday saw the first business session of the International Union itself. It was held in the Auditorium Maximum of the Ecole Polytechnique, Herr Fritz Escher presiding over a full audience of over 250 delegates. He opened with a short address, in which he referred to the organization of the Union in general and to its inauguration in London in 1931. The initiative, he said, was taken by the Institution of Gas Engineers, and at that first Congress Mr. H. E. Copp, of Hull, occupied the chair. Herr Escher then gave an outline of the work to be carried out in the comprehensive programme prepared for the delegates.

He then formally introduced the new President, M. A. Baril, Director of the Cie. d'Eclairage, Chauffage, et Force Motrice, of Paris, who was received with acclamation.

Prof. Rohn, President of the Swiss Federal School Authorities, then welcomed the Congress on behalf of the National and Cantonal Governments. Speaking in German, French, and English, he testified to the importance of the Conference and of co-operation among gas men throughout the world. He recalled that a few days previously the Polytechnic had housed a great Electrical Congress, and referred to the pronounced competition between gas and electricity. It was, he said, most important from the point of view of economics that those two branches of production of energy should work on parallel lines in the interests of economic conditions in general. That applied very much to Switzerland, where there were a large number of water sources providing electric power and where the Gas Industry had been developed for a number of years and had to make use of imported coal.

Hon. President of the Union.

M. A. Baril, having announced that the next Conference would be held in Paris in 1937, proposed that Herr Fritz Escher be elected Hon. President of the Union, as a token of their appreciation of the great service he had rendered to their cause. This received the unanimous approval of the meeting, and Herr Escher briefly but feelingly acknowledged the honour conferred upon him.

Gas and Electricity in Switzerland.

Dr. A. Dind, of Neuchâtel, President of the Swiss Society, then addressed the meeting, referring particularly to Prof. Rohn's earlier remarks on economics. The competition of electricity was, he said, a subject of very great difficulty and interest to the whole Gas Industry in Switzerland, especially in view of the advantage enjoyed by electricity of having natural power resources of the country at its disposal. In the interests of the country a Sub-Committee of the World Power Conference had been established to consider the situation, and the Gas Industry was looking forward to the result of their deliberations, which it was hoped would establish a foundation on which both industries could share on a fair basis the country's demand for energy. Dr. Dind concluded by expressing his thanks for the promise of the Authorities, as reported by Prof. Rohn, that they would help-on both industries wherever possible with research work.

Herr Escher thanked Dr. Dind for his address, and then introduced Mr. Clifford E. Paige, who read and elaborated an extract from his paper. [See last week's "JOURNAL."]

Official Dinner and Dance.

Sunday afternoon was the only time left free by the very full programme, and several members of the British party took the opportunity of visiting the magnificent showrooms of the Zurich Corporation. Of these it is hoped to publish a full account in a later issue of the "JOURNAL." In the evening there was the Official Dinner and Dance in the Grand Hotel Dolder, magnificently situated overlooking the lake from a height of about 700 ft. Herr Escher presided, being supported at the top table by our own President and ex-Presidents and their ladies, and many local dignitaries. After dinner, in accordance with Continental custom on such occasions, a toast list gave place to speeches from the Chair and from other leaders of delegations; and it was a source of considerable disappointment to the British party that no English tongue was heard, however briefly. Herr Escher referred to the assembly as a large gas family of which he was the father, and possibly his earlier career had fitted him particularly to preside over such a gathering. He had started in his father's factory in Italy, and later, after studying at Karlsruhe, he obtained an appointment as an electrical engineer in Strasbourg. Then in 1914 he was appointed Manager at Zurich. Among his early cosmopolitan friendships was a close one with Monsieur Baril, which led eventually to the formation of the International Gas Union.

Prof. Wyssling, lately a Professor of Electrical Engineering at the Polytechnic, and one of the leading electricians of the country, present on behalf of the Swiss Society of Electrical Engineers and four other Engineering Societies, followed Herr Escher. He referred to the remarkable development of the International Gas Union within these few years—that had already achieved things which the Electrical Society had taken many years to do. The problem of corrosion was a good example of a subject which might best be tackled by co-operation; and in Switzerland they already had a Joint Committee of the gas, electrical, water, railway, and government interests studying the matter. He referred to the specially sharp controversies between the gas and electrical interests in Switzerland, and expressed the opinion that the (abovementioned) Sub-Committee of the World Power Conference would assist greatly in pointing the particular field of development to each. In his opinion less attention should be given to the claims of invested capital in the industry than to the general public good.

Herr Escher then read telegrams of good wishes which had been received, among them one from Mr. H. E. Copp, of Hull, who presided at the first International Conference.

M. Baril followed with a short address of eulogy; Dr. Levi, of Turin, referred particularly to the universal pleasure it gave to have the ladies present at the function; and Dr. Urbanek, of Prague, said a few words on behalf of the Czecho-Slovakian Delegation.

It was close on 11 p.m. before an adjournment was made, and dancing thereafter continued until the early hours of Monday.

Further Business.

It is impossible, abstracts of the valuable reports and papers having already been given, to review at any length the business sessions of Monday and Tuesday, the former lasting from 9 a.m. to mid-day, the latter from 9 a.m. to 5 p.m., with an interval for lunch. There was little discussion on any of the papers or reports, with the notable exception of the British Report presented by Mr. Bennett and introduced by him only very briefly in order to allow ample time for discussion, which Herr Escher permitted to continue for twenty minutes beyond the scheduled time. An urgent appeal to Colonel Zollikofer, General Secretary of the Union, procured the transcript of this discussion in English, French, and German; and this is given on later pages, the foreign portions having been translated in the "GAS JOURNAL" Offices.

It was unfortunate that the text of the Czecho-Slovak Report and of the papers by Prof. à Brandis on "Coal Evaluation," on "Distribution of Coal Gas," by Herr

Zardecki, and on "Carbonizing by Electricity," by Dr. Böhm, were not available, but it is hoped in due course to secure these and publish extracts in our columns.

The termination of the Conference was commendably brief, consisting of little beyond a hearty repetition by M. Baril of the invitation to Paris in 1937.

The Social Side.

The programme for the ladies provided not only that they should see the maximum of a very beautiful country, but also obtain an insight into the life and commerce of the Swiss. Thus on the Saturday they were brought together for a motor tour to Schaffhausen, Neuhausen, and the lovely Falls of the Rhine. On Sunday they could choose between the Art Galleries of Zurich and the Museum of Swiss furniture, costumes, and so on. On Tuesday morning they visited Grieder's silk shop—provoking, with prices in the sky and exchange at 15 Swiss francs to the pound—and Sprüngli's tea room, where they were deeply impressed by the organization and immaculate cleanliness "behind the scenes." That afternoon Frau Escher was at home at the Bauer au Lac.

On Monday evening there was a festival performance of "Der Rosenkavalier" at the Stadttheater. Strauss's work, specially given at Herr Escher's request, is extremely popular on the Continent, though the slow movement of the plot and somewhat ponderous composition are inclined to weary the average Englishman. But Martha Rohs was delightful in the title rôle, and Emmerich the perfect Baron Ochs. All the principals received bouquets from the International Union.

The afternoon before the opera had been spent in a three-hour sail round the lake, but any comment upon this, upon the Lugano excursion, and the extended tour which followed, must be held over till next week.

(To be concluded.)

Discussion on the British Report

I.G.E. Report upon "Methods for the Development of the Use of Gas for Domestic Purposes"—see ante pp. 512-14.

Mr. C. VALON BENNETT, President of the Institution of Gas Engineers, having read a very curtailed abstract of the report, in order to give ample time for discussion—

The PRESIDENT, Herr Fritz Escher, said: All our thanks are due to Mr. Bennett for the excellent and very complete report which he has presented to us. Collaboration in advertising is perhaps the most important thing in the Gas Industry. We have clearly before us the example of collaboration between the British Commercial Gas Association and the Institution of Gas Engineers—an example upon which we can build our own future efforts. Mr. Bennett says that the need for gas has been created. That is a most important thing—we must create the need for gas; the rate is perhaps a secondary consideration. May I also thank the speaker for his appreciation of our showrooms. It is a great pleasure to us to show our English and American colleagues what we have learned from them regarding that method of advertising.

Dr. SPALECK (Dessau): In Germany also the household is the most important customer of the gas undertaking. The report is quite right in pointing out that the continual improvement in domestic gas appliances is one of the most important factors in competition. The outward appearance of appliances must naturally be suited to the differing tastes of individual countries. In Germany, following the ruling style of dwelling-house building, domestic appliances have developed along strictly practical lines, avoiding anything which might be classed as purely decorative. Improvements in the hygienic properties of the appliances have received quite particular attention. Considerable importance is attached to the safe evacuation of combustion products from water heating and other high gas consumption appliances. The favour of architects towards domestic gas appliances depends to a considerable extent upon the satisfaction of such demands, and international exchange of experiences or joint investigation in this direction is, therefore, particularly to be recommended.

Competition in Germany has called for continually increasing co-operation among all forces of the Gas Industry. Gas undertakings, manufacturers, and traders are coming together in ever closer contact in their national organization, as well as locally. Within the framework of official and private measures towards relief of unemployment, these united forces have succeeded in advancing the cause of the Industry, and increasing the output of gas and gas appliances.

Another important factor in business getting consists in the news sheets issued by gas undertakings, which are usually sent out with monthly accounts. A large proportion of domestic consumers receive these regularly. They deal in an easily understandable form with gas utilization and domestic appliances, and they make an important contribution in showing that gas can be relied upon as an important and, indeed, indispensable source of heat for the household, and in showing its very many possibilities. Careful analysis has proved that these publications are very highly regarded by the consumer. Their cost may be put at approximately 0·3% of the cost of gas delivered to householders.

Considerable attention is paid by German gas undertakings, and with excellent results, to the replacement of antiquated services and appliances in old dwelling-houses by more modern and efficient installations. The outlay involved in this is undoubtedly well repaid. Other fruitful lines of propaganda are the education of domestic science students by means of regular courses, and the supply of instructional material to schools. Demonstrations of adults, too, are held as far as possible to include housewives and prospective brides, and social organizations of all kinds are encouraged to interest themselves in such courses.

The British report recommends international co-operation and exchange of material in the realm of advertising. Even if the formal treatment of propaganda material must of necessity be different according to the taste of different countries, we agree that valuable mutual assistance can be obtained from such interchange. The thanks of the German Gas Industry are due to our British colleagues for their valuable contribution to one of the most important questions of the day.

M. SELLIÉ (Paris) said that in appointing him to enter into the discussion at the end of the British report so ably presented by Mr. Bennett, the French delegation intended in no wise to offer criticism. On the contrary, they wished to pay the greatest respect to their British colleagues for their work on the co-ordination of methods for the further development of the employment of domestic gas. That was all the easier for them since they knew of the great efforts already made by their colleagues in that direction; all those who were present at the meeting of the British Commercial Gas Association knew with what care that Association studied all questions appertaining to gas sales.

Continuing, M. Sellié said he would just like to indicate to them the efforts made by the French Gas Industry. After the war, when gas consumption in France had dropped, they created, in order to resuscitate it, the Société pour le Développement de l'Industrie du Gaz en France. The object of the Society was to place at the disposal of French gas engineers all available papers for any campaigns which they might wish to undertake; also to form a commercial personnel and to make a study of special campaigns to popularize the use of definite lines of apparatus, such as cookers, water heaters, &c. At the outset they created a journal, the object of which was to make an appeal to the greatest possible number of consumers. This paper was placed before them at the moderate price of 5 frs. per year, and on that figure they gave quite an important commission to agents who undertook to circulate it. The result had been a brilliant success, for they had now reached a figure of 200,000 subscribers, and that in the provinces only, since Paris itself had only a small proportion of the total subscribers.

They had also organized a commercial course for the education of their agents. Among the methods of publicity indicated by Mr. Bennett, he would lay particular stress on wireless publicity which had given them excellent results, particularly with coke sales. These had enjoyed a notable increase, buyers having come to them who were completely in the dark as to coke and its uses until the propaganda campaign. It was very certain that

a campaign for some particular line of apparatus was capable of giving equally good results.

M. Sellié said he would like to direct their attention in another direction—namely, the price of gas apparatus, which constituted always an obstacle to the development of gas sales. An effort must be made by the manufacturers to reduce their prices, for no sooner did their undertaking's salesmen present themselves to a consumer than they were asked the cost of the apparatus and its installation. If the price was too high they could not effect a sale whatever advantages might attach to the apparatus. Also in order to reduce the price of apparatus—particularly cookers—and in view of the competition to which they were subjected from the electricians, they had organized a competition between the different manufacturers with a view to producing the best apparatus at a price which should not exceed a given maximum. M. Sellié closed with renewed congratulations to Mr. Bennett for his report.

Col. H. Zollikofer (Zurich): The Report of the Institution of Gas Engineers gives in a concise form the general lines towards the development of the use of gas for domestic purposes. We congratulate our British colleagues on their excellent Report, which makes valuable suggestions especially to those countries which have only limited means and staffs for promoting sales. Like the countries mentioned in the Report, Switzerland also organized the testing of gas appliances; and the seal of our Society gives the consumer full guarantee for reliable gas appliances, and is promoting sales. Co-operation with plumbers and gasfitters is a question worthy of the fullest consideration, as fitters are always in closest contact with the customers. The possibility of co-operation depends upon the professional training of the fitters in the district concerned. Thus we feel the necessity for sales training of all employees, and that the instruction of plumbers is an important item.

Last year our Society ran a campaign for a gas range called "Unitype." The work included thorough tests and technical study in its construction, and helped very much to create the confidence of the public in gas appliances and gas. There is no doubt that showrooms promote the sale of gas appliances; and an exhibition well worth visiting may be found in the Zurich showrooms.

Switzerland is certainly ready to exchange all information and experience with England that may tend to the further development of the use of gas.

M. Perier (Brussels): I was greatly interested in Mr. Bennett's Report, and would like to congratulate him upon it. He says that it is necessary to create co-operation. I agree that is one of the most important things we have to consider. Would it not be possible to obtain for Gas Companies some concession so that they can do what the Electricity Companies are doing? Electric installations are not allowed, under the Act of Concession, to be completed until they have been inspected and passed. By applying the same regulation to gas, we should get the best appliances, and people would be more inclined to buy them. We have to see also that there is as much concentration as possible of gas installations. It should be arranged that for hotplates the consumer should use the burner on the "sparking iron" which is used at the same time for cooking.

Another thing is that gas appliances must be at the disposal of the consumer throughout the year. Ten years ago we began a campaign in Belgium for the avoidance of danger by substituting fixed tubing for rubber tubing. We have succeeded in many cases in persuading consumers to make this change, and the consumption of gas has increased. A coal stove in the kitchen is not so much used in the summer time, gas then being used for cooking; but in the winter, when the coal fire is used for cooking, the old rubber apparatus is often put into the attic, and when it is desired to heat the kitchen with gas, there is often no apparatus at hand. With the fixed installation, gas heating is always ready to replace a coal fire. A further point is that an undertaking ought to consider not only the sale of apparatus, but the abolition of old apparatus. It is not necessary to use in our houses unsatisfactory apparatus to achieve a large consumption.

Mr. Bennett has given a great deal of very interesting information about the consumer. Our experience is that we ought completely to separate the salesman from the inspector of the installation. The salesman is not a technical man, but the inspector must be. On the other hand, when the salesman has sold an apparatus, he is responsible for it. The inspector, however, should not lose the confidence of the public, as he may do when, having found defects in the apparatus, he is forced to admit that the responsibility rests with the salesman. The inspector should be more attracted by the idea of improving the installation than of effective new sales.

A system of propaganda which has been found useful by us is that of travelling vans, which help the small undertakings which are unable to display installations effectively.

The President then closed the discussion.

Mr. Bennett: I thank you all very much for the attention which you have given me, and hope the result of the discussion will be of interest to all gas undertakings.

Methods for the Development of the Industrial Use of Gas, including the Hotel Industry

Report presented by the Association des Gaziers Belges

It is indicated in a foreword that the amount of work entailed if all aspects of the subject had been dealt with would have been so great that it was considered advisable to limit the scope of the present report to a consideration of the general methods which are practicable for the development of the use of gas in industry. However, a table showing the principal uses of gas in industry is appended. A printed account has already been published by the Association des Gaziers Belges indicating, briefly, the various uses of gas in the more important industries. This will later be supplemented by more complete accounts of the use of gas in a few selected industries. These will, in the first place, be published in the Bulletin of the Association and will then be available to the International Gas Union. The Association will thus bear the cost of the typesetting and of the preparation of the numerous blocks involved.

The industrial use of gas cannot be developed unless knowledge is available of (1) the particular requirements of those industries which utilize thermal energy and of the manufacturing processes involved and (2) the existence of suitable appliances for the various requirements and particulars of their characteristics, methods of operation, and output.

Though the industrial sphere varies largely from the domestic sphere, ordinary propaganda can be adapted to industrial propaganda and may be carried out by means of posters, leaflets, brochures, wireless, films, advertisements in the daily Press, articles in the technical Press, conferences, exhibitions, and demonstrations. Mention is made of the value of such publications as the "Gas Salesman" supplement of the "Gas Journal" and the "Thousand-and-One Uses for Gas" bulletins.

The most effective course is the personal visitation of potential clients by generally qualified agents provided with all the necessary literature and information. Small industries require commercial propaganda; large industries require technical propaganda. The selection, remuneration, training, and stimulation of canvassers are questions of the greatest importance. Merely good salesmanship may suffice where small appliances are concerned, whereas good technical knowledge is required where the needs of medium and large industries are in question. The necessary specialized information should be obtained from periodicals, reviews, and illustrated catalogues in the central library of the gas company, from the records of plants installed and from the records of types of apparatus relating to each industry. All information collected by canvassers should be card-indexed for future reference. A central organization to which individual gas undertakings are affiliated may act as a central information bureau.

An industrial laboratory in which demonstrations can be given to clients is also essential, though, sometimes, it is necessary to carry out more ambitious tests in the factory of the potential client or in the workshops where the plant under consideration is made. In such cases, the expenses may generally be shared, the gas company paying the cost of laying the temporary main and providing a

meter and the client paying for the gas used in the test at an agreed low rate.

A manufacturer contemplating altering his plant and installing new plant will require full data and guarantees as to initial and working costs, maintenance, output, and labour, and such data should always be available.

Propaganda is useless unless gas can be provided at a price which renders its use possible. Hence the cost of production of extra gas should be carefully investigated from the viewpoint of the quantity concerned, the time of day at which it will be required, the season, &c. Tariffs can then be fixed accordingly. Information as to how gas-making costs may be dissected appropriately are given by means of a specimen calculation. In this connection, information of a more or less detailed nature is given of the various systems of industrial tariffs in use in Great Britain, Belgium, France, Germany, Holland, Poland, Switzerland, and the U.S.A.

The question of finance often needs consideration when large installations are concerned. The manufacturer of the equipment may need to offer easy terms based on the instalment system or on a share of profits. Apart from this, technical collaboration between the manufacturer and client is always necessary. Regular inspection on the part of the gas undertaking will not only enable proper provision for repairs to be made when necessary, but maintenance of such contacts will lead more and more to the development of the use of gas in the works concerned.

Co-ordination of Methods of Testing Gas Appliances

Report presented by the Union Syndicale de l'Industrie du Gaz en France.

The report summarizes information received from national organizations in Austria, Canada, Denmark, Germany, Holland, Hungary, Poland, Sweden, Switzerland, and the United States of America, as well as current practice in France in connection with the methods employed for the testing of domestic gas appliances. The appliances covered are: (1) Central heating plants in which hot water, steam, or hot air is the heating medium; (2) space heaters, such as gas radiators; (3) instantaneous water heaters; (4) storage water heaters; (5) gas cookers. Information in respect of all these types of appliances is not available from each of the countries mentioned, but the information, which is assembled very systematically in the form of detailed tables, suffices to show that practice varies considerably from country to country.

The first table is devoted to particulars of the nature and state of the gas used in the various countries for the testing of appliances and the methods by which the characteristics of the gas are defined and measured. The tables dealing with the actual testing of the appliances cover such items as (1) rating, (2) conditions of badging, (3) constructional materials, (4) safety devices and safety tests, (5) burner details, cocks, and pilots, (6) efficiency, (7) performance at low load, (8) fire prevention rules, (9) waste gas quality, (10) protection against down draught and effect of down draught in allowing combustion products or partly burnt gas to enter the room.

In appendices, full details are given relative to the methods in use in the principal countries for the determination of the carbon monoxide content of the waste gases from domestic gas appliances. Methods employed in the study of the heat distribution in domestic cookers and in the testing of the performance of boiling rings are also described.

A suggestion is finally made that there should be a uniform international basis for the comparison of the performance of domestic gas appliances, and the principles which might be agreed upon are outlined. Their adoption need not prejudice the continuance of the particular methods required by internal conditions in each country.

An important suggestion is that calorific values on the gross basis should be employed. This is of particular interest to Great Britain. The efficiency of an appliance is best defined as the ratio of the heat utilized per hour for the particular purpose for which the appliance is designed to the amount of heat supplied per hour. Heat used for other purposes, even though they may be useful, is not considered—*e.g.*, the heat radiated from a storage water heater. A proposal is made that tests should be carried out at a standard atmospheric temperature of 68° F., and that, in the case of water heaters, the rise of temperature should be 90° F. In the case of gas radiators, the amount of heat passing away with the waste gases is determined and the amount of useful heat is obtained by difference, the amount of heat radiated being also determined if desired. The efficiency of gas cookers is expressed in terms of the amount of heat consumed in raising the temperature of the oven to a standard temperature and maintaining this temperature for one hour, divided by the total surface of the cooker, including the bottom.

When standard tests on gas appliances are carried out, the appliance should, it is suggested, be fitted with a flue 39·37 in. long.

Further Points from Zurich Gas Practice

During the visit to Schlieren, several members of the British party heard of processes unusual from our point of view, and later in the week were able to inspect these through the good offices of Herr E. Ott, Assistant Director, and Herr Widmer, the Works Manager.

Sewage Gas Enrichment.

The sewage from the town of Zurich runs into a number of settling tanks. Here the sludge is allowed to settle out, and the clear water is run into the river. The sludge is pumped intermittently to water-sealed concrete tanks, four in number. It is there made alkaline with lime, and left for a period of one to two months, during which it undergoes anærobic decomposition resulting in the destruction of all dangerous organic matter. There are two possible reactions. If the material is alkaline, the resulting gas is composed of about 30% of CO_2 and nearly 70% methane, while if the action goes on under acid conditions, a great deal of H_2S is formed. Hence the lime. Once started, the action is self-supporting, and the best temperature for the reaction is 18° C.

In order to maintain this temperature, a thermostatically controlled tubular boiler, made by Körting, and heated by the sewage gas, is installed. This boiler is used for heating the sludge mixture through the medium of a tubular calorifier through which the sludge from the tanks is circulated by pumps.

The gas is generated at 8 in. to 10 in. water gauge, and passes to the gas-works, a mile away, where it is taken into the inlet of the exhausters. A safety seal is provided at the gas-works end, so that there is always a positive pressure in the sewage gas main. The gas is therefore purified along with the coal gas, although at the tanks there was no appreciable smell of H_2S in the sewage gas.

The gas generated amounts to from 2 to 3% of the town gas, and the high content of CO_2 is therefore of no moment. The calorific value of the sewage gas is, roughly, 700 B.Th.U.

Wash Oil Refrigeration.

Another interesting point is that a CO_2 refrigerating plant is used for cooling the wash oil used in the benzole recovery process. The plant is very similar to an ordinary refrigerator, except that the wash oil takes the place of the brine. It would appear at first that this is very costly, and that the cost cannot be justified by the small additional return of benzole obtained, but actually the main reason for this plant is to enable them to extract the last traces of naphthalene.

Gas is washed at approximately 4° C., and the naphthalene in the town gas averages about $\frac{1}{2}$ to $\frac{3}{4}$ grain per 100 c.ft.

It was also interesting to note that the benzole washers consist of cylinders through which the oil is spread, no packing material being used.

North British Association of Gas Managers

ANNUAL MEETING IN INVERNESS

The Seventy-Third Annual General Meeting of the North British Association of Gas Managers was held in the Town Hall, Inverness, on Sept. 6.

The PRESIDENT (Mr. Lewis Bain, Cullen and Banff), in opening the meeting said that he was exceedingly gratified to find that such a large and representative company had come to the fair city of Inverness to attend what he knew would be a pleasant and profitable meeting. He felt that the occasion was one which he could not allow to pass without expressing the Association's sympathy to the people of Inverness in the loss which they had sustained by the death of Provost Mackenzie. It had been his privilege and honour to know the late Provost intimately, and he knew that he had been looking forward with great interest to this present meeting.

A hearty welcome was extended to the Association on behalf of the Town Council of Inverness by the Senior Magistrate, Bailie FRASER, who said that he was very pleased that Inverness had been selected for the meeting, as he believed that this was the first occasion on which the Association had met in the Capital of the Highlands.

The HON. SECRETARY (Mr. Arch. Kellock, Airdrie) read the minutes of the last meeting, which were approved; after which he intimated that apologies for absence had been received from, among others, Mr. C. Valon Bennett (President of the Institution of Gas Engineers), Mr. J. R. W. Alexander (Secretary of the Institution), and Presidents and Secretaries of kindred Associations.

The Annual Report.

The PRESIDENT, in asking the meeting to approve the Annual Report, said that he was pleased that Sir Francis Goodenough had sufficiently recovered from his recent illness to be present.

In commenting on the Report, Mr. JOHN WILSON (Dundee) said that the regulations set forth by the Scottish District Committee in the paragraph on Education might prove to be harsh in some cases. In Centres like Dundee, where it was not possible to form a gas class every year, a student in his final year might find that there was no class available and would therefore be unable to comply with the Regulations. He felt that something should be done about this.

Mr. DAVID FULTON (Helensburgh) said that the Regulations governing the Final Year Course applied to auxiliary subjects which required to be of the same standard in every College. It did not matter if the Principal Subject was taken in the final year or not as this was external.

The Report was approved.

Extraordinary Membership.

The PRESIDENT then brought forward a motion regarding the election of extraordinary members. He said that this was not a private motion but was being brought forward by the Council who had produced an approved rule which had been circulated. They were always delighted to have Extraordinary Members, but he did not think it desirable to have numerous representatives from one firm.

The rule was adopted.

The President, in presenting certificates to successful examination candidates, said that while he congratulated them on their success he would remind them that the gaining of a certificate was not the hallmark of completion but merely the beginning. The following certificates were awarded:

Gas Engineering, Higher Grade, First Class.
C. E. M. Freshney, Barrhead.
W. M. Gledhill, Stirling.
E. G. Smith, Dumbarton.

Gas Engineering, Higher Grade, Second Class.
W. Gilchrist, Kilmarnock.
W. Rose, Kilmarnock.

Gas Supply, Higher Grade, First Class.
W. C. Campbell, Helensburgh.

Gas Supply, Higher Grade, Second Class.
W. A. Currie, Glasgow.
C. E. M. Freshney, Barrhead.

The Secretary and the President, with Sir Francis Goodenough.

The President Surveys the Scene.

Mr. W. Ross Taylor, M.P., and Major Sir McKenzie Wood, M.P.

The SECRETARY then intimated that the following new Extraordinary Members had been admitted to the Association: Messrs. David Gibb (Gothic Works, Falkirk), Charles Gray (Leigh-on-Sea), and John Simpson, Glasgow.

The following papers were then read: "Carbonizing Policy Relative to Geographical Situation," by Mr. A. Jamieson (Johnstone); "Town Gas for Steam Raising," by Mr. D. Morton (Arbroath); and "Hot Water by Gas: Domestic Hot Water Supply and Central Heating," by Mr. D. C. K. Parkinson. The first two papers, together with reports of the discussions thereon, are published on later pages of this issue, while Mr. Parkinson's will appear in next week's "JOURNAL."

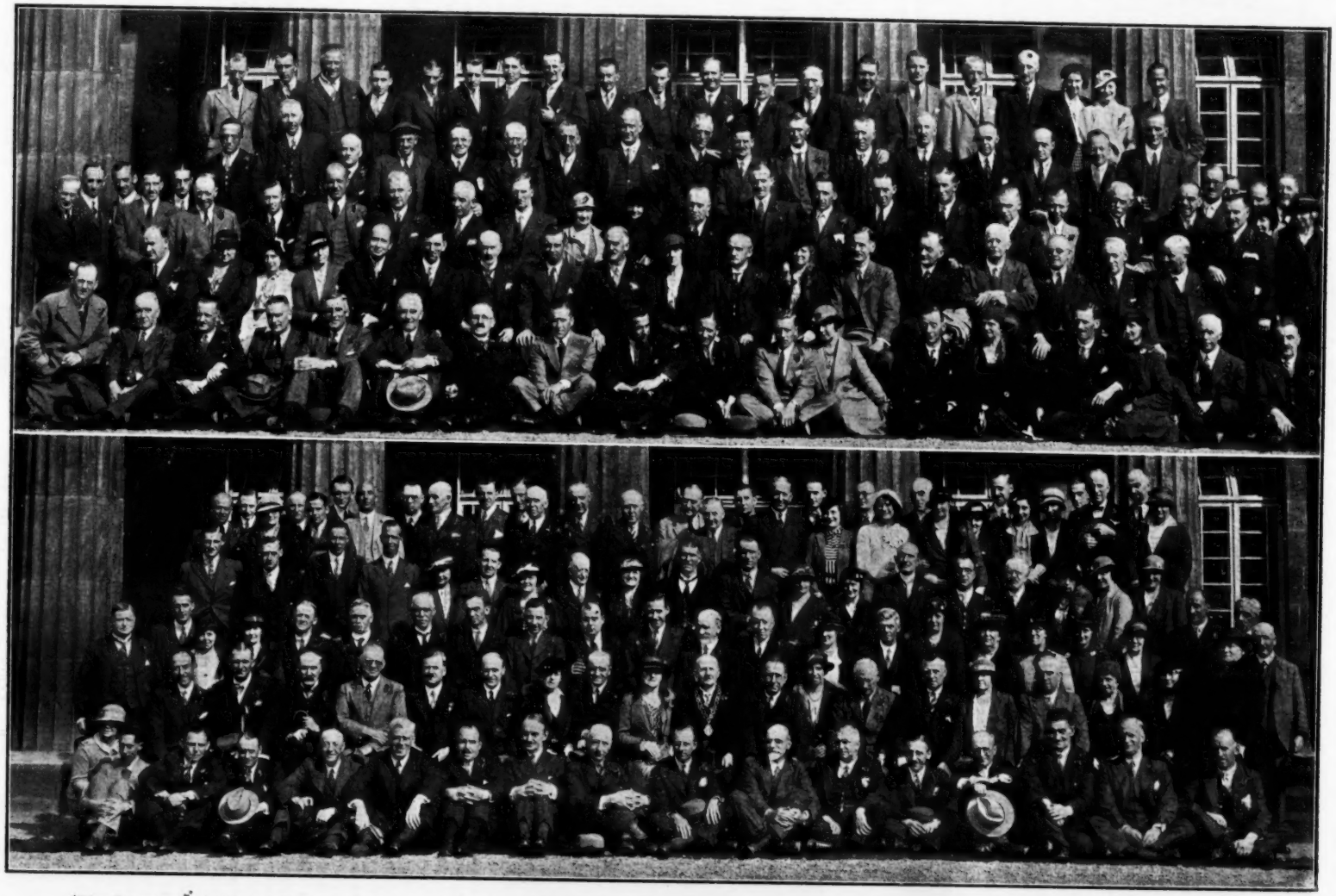
New Officers.

The Report of the Scrutineers was read by the Secretary, and the election of the following new Officers was announced:

President.—George Bruce (St. Andrews).
Junior Vice-President.—James Jamieson (Edinburgh).
Ordinary Members of Council.—H. A. Aitken (Leven), A. McDonald (Motherwell and Wishaw).

The PRESIDENT said that it was his duty to welcome the new President, Mr. Bruce. He was delighted to have the

GROUP AT THE NORTH BRITISH MEETING AT INVERNESS



(The Secretary of the Association asks us to state that copies of the Group Photograph may be obtained from Paterson, Academy Street, Inverness.)

pleasure of congratulating Mr. Bruce, who was another Banffshire man. He was also pleased to welcome Mr. Jamieson, who succeeded Mr. Dickson, Kirkintilloch, in the Office of Junior Vice-President.

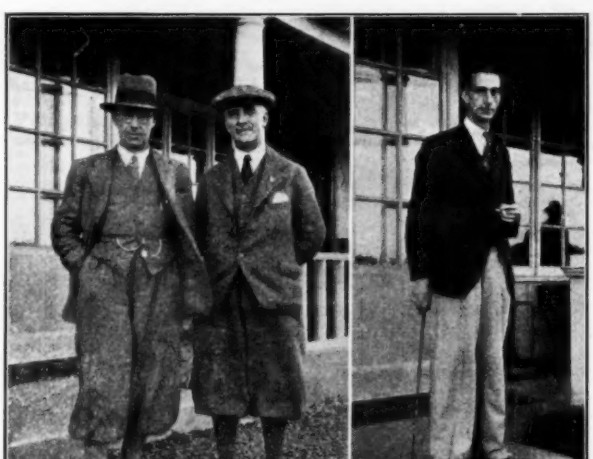
Mr. BRUCE thanked the Association for the honour they had conferred on him, and though he had been diffident in accepting he would strive to uphold the high prestige of the position.

Mr. A. S. NISBET (Paisley), the immediate Past-President, in presenting Mr. Bain with the President's Memento, said that his duty was so pleasant that the depression which had settled on him on vacating office was now, for the first time, being lifted. He congratulated Mr. Bain on the success of his year of office—a success which could be attributed to the quality of the President, his ability to conduct business, his suavity, his ease of manner, and, above all, his great worth of character.

Mr. BAIN said that he found it hard to respond, but he fully appreciated the honour which had been conferred on him, and he had tried to emulate the example of Mr. Nisbet. He hoped that in this he had not failed.

Mr. S. MILNE (Aberdeen) proposed a vote of thanks to the Scrutineers, to the readers of the papers which were so truly worthy of the Association, to the President for having so ably occupied the chair, to the Secretary, members of Council, and Magistrates and Council of Inverness.

Mr. BAIN replied and was supported by Mr. KELLOCK.



The Golf Captain, Mr. John Wilson, with Mr. J. O. Scott, indefatigable Hon. Sec. of the Circle.

Reader of a Paper and Winner of the Golf Challenge Bowl—Mr. A. Jamieson, Johnstone.

President's Luncheon.

At the conclusion of the morning session a number of the members, in addition to Sir Francis Goodenough, Major Sir M. McKenzie Wood (M.P. for Banffshire), Mr. D. T. Samson (Deputy Lieutenant for Banffshire), Bailie Fraser (Inverness), Mr. J. W. Napier, and Mr. J. W. McLusky (Glasgow) were entertained at luncheon by the President in the Station Hotel, Inverness.

After observation of the Loyal Toast, the toast of "The President" was given by Mr. SAMSON. He said that the presence of members from all parts of Scotland and from England testified to the success of this meeting, and the pivot of this success was President Bain. One of the President's aims in life was the perfection, extension, and consolidation of the Gas Industry, and in this he had achieved notable success, as the output in Banff had increased by leaps and bounds. He had no time to do full justice to President Bain; he was a worthy President and in honouring him the Association had honoured itself.

The PRESIDENT, in reply, said that as time was growing short he would take the advice of a friend to whom a short speech was "thank you" and a long one, "thank you very much." What had been said of him was all too kind, but his aim was always to leave his fellow a little better than he found him.

The toast of "The Gas Industry" was proposed by Sir MURDOCH MCKENZIE WOOD, M.P., who said that his greatest qualification for being here was that he was a fellow townsman of the President. He thought it was a great mistake to consider that gas and electricity were engaged in a life and death struggle in which one or other was bound to go under. This fallacy was easily disposed. There were many cases where the introduction of electricity had resulted in an increased demand for gas. There was room for both, and each ought to have a clear field and no favour and then each would adjust itself to its own needs. New developments in industrial life had made it essential that the interests of the Industry should be carefully guarded from the point of view of legislation. He was sure that the Industry was in good hands and was bound to succeed.

Mr. NAPIER replied, and said that electricity did not govern the position of gas. From a recent tour in Canada and America he was aware of the great strides the Industry was making in these countries in the face of electrical competition. His connection with many companies along the Moray Firth enabled him to speak with authority on the position nearer home. In Elgin the output of gas had been increased by 50% and was being sold at 3s. 2d. per 1,000 c.ft. in spite of a freight charge of 13s. 9d. per ton on the coal used. The Industry was thus showing its ability to carry out its duty and would continue to do so without grants from Parliament.

Civic Reception.

In the evening members of the Association and friends were entertained by the Town Council of Inverness in the Northern Meetings Rooms. The guests were received by the Senior Magistrate, Bailie Fraser. A dance had been arranged and proved to be an immediate success. At intervals during the evening exhibitions of Highland dancing were given by youthful dancers in Highland array. During the proceedings Mrs. BAIN graciously presented the prizes for the Ladies' Golf and Mr. KELLOCK took the opportunity of expressing the Association's appreciation of the great services which had been rendered by Mr. A. Thomson, of Inverness. Mr. Thomson had made all the arrangements and to him the success of the meeting could be largely attributed.

Mr. THOMSON said that anything which he had done had been a great pleasure and if the members had enjoyed their visit to the Capital of the Highlands he was more than repaid.

Excursion.

On Friday morning the weather was threatening, but this did not prevent about 150 members setting out in motor buses to explore some of the picturesque Highland scenery. The first part of the journey was along Loch Ness side, but the Monster was not playing and the party turned up Glen Urquhart without having had a glimpse of this elusive creature. Rain pursued the party through Glen Urquhart to the more level country in Strath Glass. From there to Beauly the scenery was of that indescribable nature so typical of the Highlands, with long stretches of wooded hillside, tumbling rivers, and mist covered mountain looming in the background. Muir of Ord and Conon Bridge next saw the advance of gas, and soon the Highland Hotel, Strathpeffer, welcomed us to lunch. From Strathpeffer a run along the main North road brought the party back to Inverness, where it was evident that the inclemency of the weather had in no way detracted from the success of the day.

The Golf Circle.

The competition for the Association Challenge Bowl was played in brilliant weather over the Culcabock Golf Course, Inverness. A large number of players competed, and the trophy was won by Alexander Jamieson, Johnstone, with a score of 87 − 17 = 70. The Scratch Prize was annexed by R. Stewart, Auchterarder, with a score of 78. The complete prize list was as follows:

SECTION 1.

(Handicaps up to and including 15.)

	1st	R. Stewart, Auchterarder
	2nd	E. V. Chalmers, Dunblane
Tie	3rd	Alan Young, Edinburgh
	4th	David Fulton, Helensburgh
Tie	5th	R. B. Waddell, Polmont
	6th	C. Hamilton, Loanhead

SECTION 2.

(Handicaps over 15.)

	1st	Alex. Jamieson, Johnstone
	2nd	L. Gardner, Lenzie
	3rd	M. D. Campbell, Bridge of Weir
Tie	4th	J. M. Adams, Glasgow
	5th	Robt. Hamilton, Dalkeith
	6th	I. F. Scott, Leslie

After the day's play was over the meeting of the Golf Circle was held in the clubhouse. The Captain, Mr. John Wilson, Dundee, presided, and after a few fitting remarks called upon Mrs. Lewis Bain to present the prizes to the

successful competitors. Mr. Wilson then proposed a vote of thanks to Mrs. Bain for having so kindly consented to come and present the prizes, and Mr. Bain suitably replied on behalf of his wife.

Mr. Walter Hudson, Manchester, was appointed Captain for the coming year, and expressed his appreciation of the

The Ladies' Golf Circle Meet at Nairn.

honour which had been conferred on him. Mr. Wilson then presented, *in absentio*, the ex-Captain's badge to Mr. MacLay and instructed the Secretary, Mr. J. O. Scott, to convey the Circle's appreciation to Mr. MacLay. The Captain then proposed a vote of thanks to the Inverness Golf Club who, he said, had not only conferred the courtesy of the course on the Circle for all three days of the meeting, but had done everything in their power to make the day a success. The warmest thanks of the members was therefore due to Mr. Ward, the President of the Club, Major David Ross, the Secretary, Mr. Fraser, the Professional, and above all to their colleague Mr. Thomson who had been responsible for all the arrangements.

The Bowling Cup.

The annual competition of the Bowling Club took place at the Inverness Bowling Green on the Wednesday, six rinks taking part in the competition, after which Mrs. Bain presented the prizes. On the call of Mr. J. M. Ireland, President of the Bowling Club, a hearty vote of thanks was given to the members of the Inverness Club for permitting the use of the Green. The results were as follows:

Winning Rink—25 shots up.—K. MacKay, A. P. Dale, R. A. Harvey, J. S. McGill (Skip).

The second prizes were presented to the following who were 11 shots up:

Second Rink—11 shots up.—J. Tully, J. Wilson, J. W. Beveridge, G. Burns (Skip).

Ladies' Golf.

While the men were doing battle at Culcabock the ladies were engaged in a private war on the Nairn Golf Course. The weather was ideal for play, and the results were as follows:

1st Prize.—Mrs. J. B. Wilson, Neilston.
2nd Prize.—Mrs. T. A. Rowan, Thurso.
3rd Prize.—Miss Mackay, Oban.

Occupational Hazards in the Chemical Industry

In a paper which he read before the Ottawa Section of the Society of Chemical Industry, Dr. J. Grant Cunningham, who is the Director of the Industrial Hygiene Division in the Ottawa Department of Health, drew attention to the serious results of the ingestion of certain toxic substances into the human system. He stated that the distillation products of coal and petroleum present some interesting occupational hazards. The aromatic hydrocarbons are apparently more toxic. Of these, benzene is the most important industrially. Roughly, as the boiling point increases, the toxicity is reduced. The effects noted with exposures to benzene are now considered to be due to benzene itself and in concentrations as low as one hundred parts per million of air.

If fresh air is breathed a large proportion of benzene is eliminated through the lungs, but perhaps one quarter is oxidized in the body to phenol and dihydroxybenzenes which combine with sulphuric and glycuronic acids to be eliminated in the urine. In high concentrations this substance produces asphyxia, but with lower repeated exposure the blood-forming organs are attacked to produce a reduction in white cell count and later in red cell count with changes in size and shape of cells and reduction of hæmoglobin.

There is a platelet reduction which is associated with the occurrence of small or large hæmorrhages which may be located anywhere in the body, and the reduced white cell count is associated with increased susceptibility to infection. Henderson and Haggard suggest that these effects may arise from the oxidation products which tend to accumulate on repeated exposure.

Different Effects of Benzene and Toluene.

The bone marrow is not attacked by toluene or xylene, but in disposal of these substances by the body the methyl side chains are affected so that toluene is oxidized to benzoic acid which combines with glycolol to form hippuric acid, while xylene forms toluic acid which combines with glycolol to form toluric acid. One is impressed with the marked difference in the mode of action of benzene and toluene with such an insignificant difference in chemical structure.

Of the derivatives of benzene, aniline itself is poisonous. It is readily absorbed through the skin producing methemoglobin in the blood, that is, there is diminished power of the blood to absorb oxygen. It is oxidized to para-amido phenol which is only slightly toxic, and sulphuric acid. It attacks the central nervous system.

Of the high boiling point distillation products the most important is the fraction thought to contain a carcinogenic substance which appears in tar, pitch, and in paraffin in varying degrees, depending upon the source of raw material. In coal and petroleum distillation the anthracene fraction boiling at about 300° C. is thought to contain this substance. Experimentally, cancer has been produced in mice by the repeated application of this material. Attention was first drawn to its importance by the occurrence of cancer cases in chimney sweeps, gas stokers, patent fuel workers, and others exposed to constant contact with coal tar products.

Risk of Pulmonary Œdema.

The common gaseous substances encountered in industry divide themselves for practical purposes into those which irritate the upper respiratory tract and consequently provide warning of their presence, and those which cannot be detected easily, if at all, but which produce damage when they reach the lungs. In the first group are chlorine, sulphur dioxide, and ammonia, and in the second group are nitrous fumes, cyanides, and carbon monoxide. Hydrogen sulphide produces a local irritation after some delay and is detected only in low concentrations for just a short period so that it really falls into the second group. Substances like nitrous fumes, hydrogen sulphide, arsenuretted hydrogen are particularly dangerous because of this delayed action. The individual suffers an exposure and only some hours later develops discomfort in breathing which is seldom related to the cause. Respiration becomes progressively more difficult with cyanosis, prostration, and death, due to pulmonary œdema. Recovery when it occurs is a long and tedious process.

Effects of Hydrogen Sulphide.

Hydrogen sulphide is a very common laboratory exposure to which sufficient attention has not been paid. The "rotten egg" odour can be detected in concentrations of ten parts per million but the sense of smell is soon fatigued so that the individual ceases to recognize its presence. In higher concentrations it produces a sense of oppression in the chest, headache, nausea, and weakness, with eventual paralysis of the respiratory centre. If it is not fatal immediately, œdema of the lungs may develop even after four or five days. Apparently the body can handle this substance up to a certain point, following which it is quickly fatal. Its disposal in the body is not understood but apparently it is loosely held, for injection into body cavities is soon followed by its detection in expired air. One hundred and fifty parts per million in air will produce symptoms in a few hours, while cyanides at about sixty parts per million produce a similar condition. At high concentrations the dose of these two substances to produce death is about the same.

Carbonizing Policy Relative to Geographical Situation

By Alexander Jamieson, Assoc.M.Inst.Gas E., Engineer and Manager of the Johnstone (Renfrewshire) Corporation Gas-Works

[Paper presented at the North British Association of Gas Managers, Sept. 6, 1934.]

I believe that never at any time in the history of our Industry was efficiency more necessary than it is to-day. We are faced with competition from other forms of light, power, and heat, we are offered alternative supplies of gas and coke, and if we are to retain our position as premier purveyors of smokeless fuel, whether gaseous, liquid, or solid, it is incumbent upon us to take advantage of any improved plant or methods of production which are available.

Electricity is to-day the spoiled child, but spoiled children have a knack of developing expensive habits and not coming up to the expectations of their more ardent sponsors, and I am convinced that the day is not far distant when not only our politicians but the fuel consuming public will again look to the Gas Industry for the economic satisfaction of their requirements in light, power, and heat. At the present time we are waging war with a younger opponent, we have also a return to the field of the advocates of raw coal, and while oil may be at the present time somewhat handicapped in its activities, due to Government restriction, our other competitors are backed and assisted to an extent which I doubt would be tolerated in any other country.

Nevertheless, I am optimistic enough to believe that our Industry is strong enough to combat even the most formidable opposition and will come out of the fight in not only a more strongly entrenched position, but as a much more efficient Industry than it has ever been in the past. We have a process which has stood the test of over 120 years, and which has throughout that period never ceased to show improvement. We have the plant and the organization, and it is only close co-operation, combined effort, and confidence we require to win.

Recent Developments.

Developments take place rapidly. Benzole recovery and the use of compressed gas in road vehicles are two promising instances in which the Gas Industry is providing substitutes for fuels which are imported in huge quantities.

But the development of scientific price scales is not proceeding as quickly as could be wished. It is, perhaps, unfortunate that the National Gas Council has not been able to give a strong lead in this matter. No doubt there are difficulties involved in the antiquated laws under which our Industry still suffers, but this will be to a great extent removed by the Bill which may be in force by the time this paper is read, and if a sound scheme was prepared by the National Gas Council and published, Municipalities would follow the lead thus given and scales suitable to the different local conditions would be promulgated. In this connection the paper contributed by Mr. H. Curtis to the last Annual Conference of the Institution of Gas Engineers, and particularly the discussion upon it, will be of value. The respective merits of a flat charge with discounts, a graduated block system, and a two, or more, part tariff are still open to question, but the writer is prepared to follow any decided lead which the Gas Industry cares to give in the direction of standardizing methods of charging. The scale of charges at Johnstone is an example of the block system.

Scale of Charges at Johnstone.

—	Ordinary.	Automatic.
For all gas used up to 336 therms . . .	6·90d. per therm	7·90d. per therm
Or 80,000 c.ft. per year	2s. 4·98d. per 1,000 c.ft.	2s. 9·18d. per 1,000 c.ft.
For the next 1,764 therms	5·65d. per therm	5·65d. per therm
Or 420,000 c.ft. . . .	1s. 11·73d. per 1,000 c.ft.	1s. 11·73d. per 1,000 c.ft.
For the next 2,100 therms	5·40d. per therm	5·40d per therm
Or 500,000 c.ft. . . .	1s. 10·68d. per 1,000 c.ft.	1s. 10·68d. per 1,000 c.ft.
For the next 4,200 therms	5·15d. per therm	5·15d per therm
Or 1,000,000 c.ft. . .	1s. 9·63d per 1,000 c.ft.	1s. 9·63d. per 1,000 c ft.
Balance at	3·90d. per therm	3·90d. per therm
	1s. 4·38d. per 1,000 c.ft.	1s. 4·38d. per 1,000 c.ft.

Standard Quality of Gas.

The question of a standard quality of gas has often been discussed, and wide differences of opinion are apparent. There appear to be at least three schools of thought on this subject, and the arguments for and against each are worthy of examination.

First we have the difficulties of a standard calorific value throughout the Industry. Standardization has many attractions in theory. It is a practice of nearly every well-known industry. Our gas-making plant, whether the two-stage process or the continuous vertical retort, has sufficient flexibility to operate efficiently for the production of gas of practically any calorific value from 500 B.Th.U. downwards, so that there would be no technical difficulty in adopting a standard within these limits.

But the technical aspect is only one of those from which this problem must be viewed. We are not at all in the same position as the electrical industry in which the voltage, periodicity, and other characteristics of the current generated are not in any way influenced by the grade of fuel consumed in the steam-raising plant. Our carbonizing plants are affected vitally by the characteristics of the coals available, and the cost of gas production is influenced very strongly by the locally varying conditions of the markets for residuals. And we cannot afford to make any but the cheapest possible gas.

A standard quality would facilitate the production of cheap appliances for the utilization of gas and the improvement of their efficiency. In our own case, for example—and it must be similar to many others—appliances are in use which are manufactured in London, Birmingham, Leeds, Warrington, Manchester, and Falkirk—and tested on gas with calorific values of 560, 500, 480, 475, 470, 450, and 430 B.Th.U., respectively. These appliances are used in Johnstone with gas at 420 B.Th.U. It is highly creditable to the design and flexibility of this apparatus that high efficiencies are possible under such unfavourable conditions. It is only by the use of gas and air regulators, however, that the difficulties have been overcome; but so long as such regulation is necessary, and so long as these adjustments are left largely to the untechnical consumer, the maximum efficiency of utilization will not be attained. With a standard calorific value a fixed nipple, scientifically designed, would be valuable—surely a step in the right direction.

There are, of course, complications. A thorough-going standardization means not only standard calorific value but standard composition and specific gravity, and in view of the wide variations in the composition of the coal carbonized, the attainment of standards in these respects may well be impossible.

The supporters of fewer declared values are on stronger ground. The 27 different declarations at present in existence are not justified by such variations in coal characteristics and market conditions as exist in Great Britain. From available data it would appear that something like 540 B.Th.U. would cover all the instances where "straight gas" is made from the richer English coals. 500 B.Th.U. would probably cover instances of "straight gas" with the poorer coals, and cases in which the coke market is relatively favourable. Lower values would be fixed by the "steaming properties" of the coals available, but it cannot be contended that these are so finely graded as to warrant more than, say, three other values, which might be 475 for the highly coking coals of Durham, 450 for the Yorkshires, and 400 for the coals available in Scotland. These figures are put forward with all due diffidence. Their exact determination is a matter for carbonizing experts. But the adoption of some such values, four or five in number, would be a good step in the direction of standardization.

In dealing with the two main schools of thought, we have, to a great extent, anticipated the arguments of those who are opposed to any standardization at all. The effect of coke prices and the market for residuals generally in

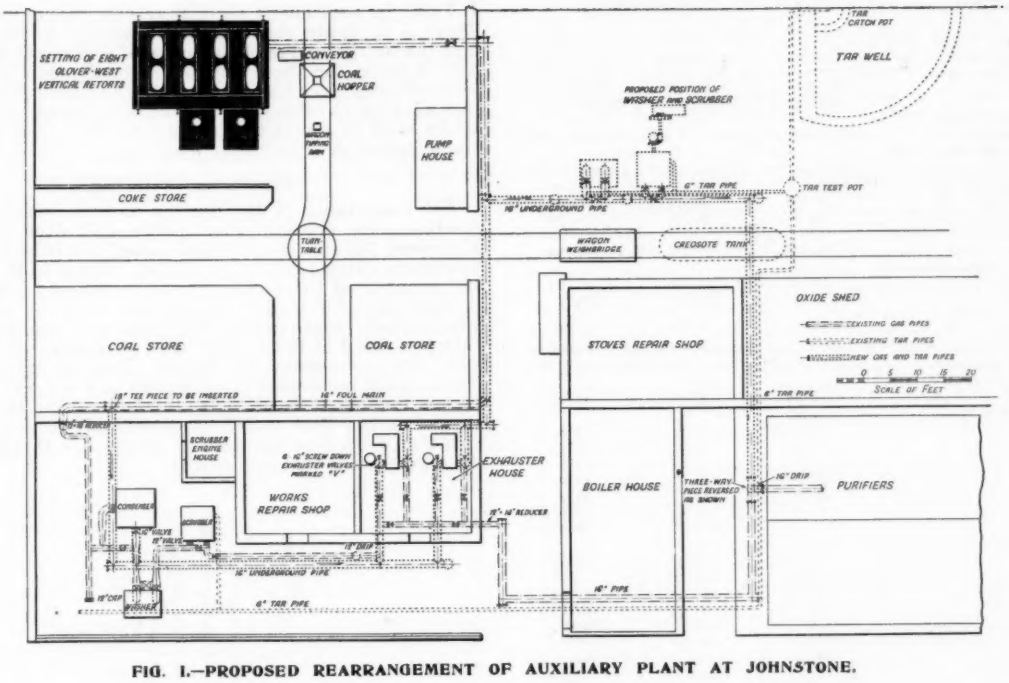


FIG. I.—PROPOSED REARRANGEMENT OF AUXILIARY PLANT AT JOHNSTONE.

relation to coal cost is the principal factor, but the question is further complicated by the effect of benzole recovery and the fluctuating value of tar on the cost of gas.

Carbonizing Policy at Johnstone.

Taking all the factors into account, it seems probable that so long as we continue to manufacture gas by methods in which the cost is influenced by the value of bye-products, declared calorific values will continue to differ according to the geographical situation of the undertaking in relation to the several coalfields, and the advantages which would undoubtedly accrue from a standardized quality will not be realized.

Under present manufacturing conditions, then, the correct calorific value to be supplied by any undertaking is that which will favour the production of the cheapest therm in view of the market, both as to extent and as to value, for the principal bye-products.

At Johnstone the annual output of gas is 146 million c.ft. and the total saleable coke approximately 2,200 tons. The average price realized per ton of coke being 30 to 35% higher than that paid for coal, this is a case in which it would seem that the cheapest therm would not be produced at a relatively low calorific value. But the yield of gas and coke per ton of coal at the quality of 420 B.Th.U. per c.ft. just meets the local demand for each, and consequently it may be taken that this is the most economical thermal value in this particular instance. If any more coke were thrown on to the market it could only be disposed of at prices which would reduce the average.

The Works and Plant.

The carbonizing plant consists of eight 50-in. "New Model" Glover-West vertical retorts, built in silica, of an aggregate nominal capacity of 800,000 c.ft. of gas per day at 420 B.Th.U. per c.ft. They are designed in units of two, and there are two producers each capable of supplying the fuel gas requirements of any four retorts.

Prior to 1930 the bench was of the original "Wilson" design, and comprised 18 vertical retorts, giving a total gas output of 720,000 c.ft. per day.

The reconstruction of the plant was carried out in two stages, six retorts being installed in 1930 and a further two last year, leaving sufficient space in the original house for four further retorts when necessary.

A Spencer-Bonecourt vertical waste-heat boiler of the natural-draught type, designed to evaporate 128 gallons of water per hour, was incorporated in the design for reconstruction. This unit is complete with feed-water heater, through which passes the exhaust steam from the extractor engines, thus raising the temperature of the feed-water by approximately 90° F.

The auxiliary plant consists of a Clapham water-cooled condenser, Livesey washer, and a Holmes scrubber, from which the gas passes to the exhauster, and thence to the purifiers which are four in number, of the dry lute type, and of a capacity of 1 million c.ft. per day.

This circuit, it will be observed, is not the generally accepted one. It requires excessive exhauster pull to draw the gas from the retort house through the various units and has the further disadvantage of considerably reducing the amount of pull at the retort house governor, the pull being only 7/10 in. at this point with an exhauster vacuum of 6½ in., thus appreciably diminishing the sensitivity of the governor.

The rearrangement of the auxiliary plant is now in hand, and I show on the plan of the works (fig. 1) the revised circuit, in dotted lines, the existing ones being shown by chain lines. When these alterations are completed there will be a considerable saving in steam, less wear and tear on the exhauster, and much better governing conditions on the carbonizing plant.

Carbonizing Results.

The coals carbonized are Ayrshire and Lanarkshire screened washed double nuts, and the three principal coals have been tested, the results being given in Table No. 1.

At the time of testing, four retorts were in operation, heated by one producer, and it should be stated that the retort temperatures were slightly lower than normal, the extension of the carbonizing plant being in progress at the time.

The average temperatures in the circulating and combustion chambers during the time of the tests are shown on the following sectional sketch (fig. 2).

All precautions were taken to keep an accurate record of the quality of the gas, the Boys calorimeter and the Simmance-Abady recording calorimeter being connected to the "make" at the outlet of the station meter. A test on the Boys calorimeter was carried out each hour during the test periods.

An accurate check was kept on all coal elevated, the coal being weighed over the weighbridge and also checked against a measured bunker capacity, levelled, and rechecked at the end of the three days which constituted the test period for each coal. A further precautionary measure, taken to ensure that the coal under test was actually in the retort for the commencement of the test, was the elevating of the same coal 24 hours before the test was due to begin. The weights of coke were all similarly treated.

Effect of Variation in Coal Supplies.

Where it is possible to obtain regular deliveries, it is an advantage to carbonize one class of coal evenly sized, and, where this is not possible, care should be exercised to see that the coal varies as little as possible in size, composition, and coking qualities.

This statement is made notwithstanding the fact that the adjustments provided in installations of the modern continuous vertical retorts are so convenient that the retort conditions can be readily and comparatively rapidly ad-

TABLE No. 1.—*Tests on Three Coals at Present in Use.*

Test No.	A	B	C
Class of coal	Washed double nuts	Washed double nuts	Washed double nuts
Duration of test in hours	72	72	72
Coal carbonized	47 tons 17 cwt.	46 tons 0 cwt.	41 tons 10 cwt.
Throughput per retort per day	4 tons 0 cwt.	3 tons 17 cwt.	3 tons 9 cwt.
Gas made, c.ft. per day	1,000,000	1,089,000	885,000
Gas made per ton, c.ft.	20,898	23,674	21,325
Gas made per ton, therms	89·12	99·36	90·57
Gas made per retort, c.ft. per day	83,333	90,750	73,750
Gas made per ton, corrected to 420 B.Th.U.	21,221	23,659	21,563
Calorific value	426·5	419·7	424·7
Coke per ton in cwt.	13·00	12·61	12·90
Breeze per ton in cwt.			
Total coke and breeze made	30 tons 12 cwt.	29 tons 0 cwt.	26 tons 16 cwt.
Coke used in producers	9 tons 0 cwt.	9 tons 8 cwt.	9 tons 8 cwt.
Coke used per 100 lbs. coal carbonized	18·81	20·43	22·65
Analysis of gas—			
CO_2	4·0	4·0	4·3
C_nH_m	1·4	1·4	1·5
O_2	0·3	0·3	0·3
CO	26·1	25·8	25·0
H_2	45·0	44·8	44·7
CH_4	15·9	15·6	15·9
N_2	7·3	8·1	8·3
Analysis of coal—			
Moisture	7·42	7·35	9·10
Ash	3·35	3·10	4·78
Volatile matter	36·07	36·10	36·35
Fixed carbon	53·16	53·45	49·77
Coke button	Hard	Hard	Hard
Ash colour	Cream	Cream	Fawn
Swelling	100%	75%	*Nil*
Calorific value	13,700	14,000	13,350
Analysis of coke—			
Moisture	4·53	4·45	4·30
Ash	9·48	7·45	9·93
Volatile matter	3·97	2·85	3·85
Fixed carbon	82·02	85·25	81·92
Calorific value	12,030	12,750	12,450
Coke grading—			
0 in.–½ in.	3·25%	2·90%	3·06%
½ in.–1 in.	11·55 ,,	17·15 ,,	19·38 ,,
1 in.–1½ in.	20·58 ,,	22·49 ,,	28·40 ,,
Over 1½ in.	64·62 ,,	57·46 ,,	49·16 ,,
Steam pressure to retorts in lbs.	20·13	20·3	11·57
Steam temperature, ° F.	231·2	236	219·8
Number of steam notches	8	8	8
Steam to each retort, lbs. per hour	65	65	49
% steam	17·5	18	15
Number of retorts	4	4	4
Average number of teeth	7·1	6·2	5·5
Speed of extractor gear, r.p.m.	2·48	2·46	2·5

justed to the requirements of any standard gas-making coal. Each size and quality of coal has a definite carbonizing time for the attaining of optimum results. No doubt, this fact was better known to the engineer operating horizontal retorts, an experience I unfortunately missed, having been born in an age when the continuous vertical retort had become practically standard equipment in most works in Scotland. But I had the good fortune to come on some notes of my father's on coal testing, in which great stress was laid upon this fact. The production of gas during each 30 minutes of the carbonizing period was logged and notes made whether 4, 6, or 8 hour charging produced the best results. The equivalent of this in the continuous vertical retort is the daily throughput per retort in relation to combustion chamber temperatures. Indeed, there are three factors—namely, throughput, combustion chamber temperature, and steam admission—and to obtain the best results at the given calorific value, these factors interact upon one another. Successfully to carbonize a variety of coals it is not only desirable but essential that every advantage should be taken of the adjustments of these factors.

It will be evident, however, that the best possible results are obtained when, as stated, the plant is adjusted to the requirements of a particular class of coal with only limited variations.

Large samples of the coals available should be put through the plant, and their behaviour studied. In each case the conditions should be adjusted to give the optimum results, and these compared. In our case it is found that the best results are obtained with washed double and treble nuts. The presence of fines prolongs the carbonizing time and limits the effect of steaming. The coke produced is denser and does not present the same open structure for steaming, so that high thermal yields at a comparatively low calorific value can only be obtained by sacrificing plant capacity.

Scotch double nuts for the production of gas below 450 B.Th.U. in continuous vertical retorts cannot be excelled. There is no doubt that this fact is known to the collieries, and the market value of this class of fuel tends to increase. The demand for these and other small coals is growing, and collieries have had to put down breaking plant to keep pits working to capacity. On the other hand, we may ourselves have to revert to the purchase of screened coal and the installation of breaking plant.

Producer Working.

The importance of the quality of fuel consumed in the producers for heating retort settings is often overlooked. For every 100 lbs. of coal carbonized, the coke used in the producers varies from 12½ to 25 lbs. When to this is added the quantity of breeze used for steam-raising purposes and of coke used for water gas, we find that the quantity of coke actually consumed on the works may amount to more than one-third of the total weight produced. Next to coal cost, this represents the biggest item in manufacturing costs, and in our case it is equivalent to 2·97d. per 1,000 c.ft. of gas made. It is obvious, therefore, that the care bestowed on this item should be second only to that which we spend on recording the number of gaseous therms we produce per ton of coal carbonized.

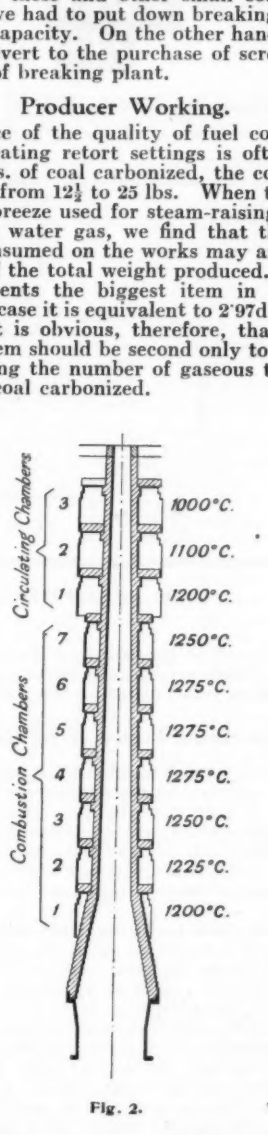


Fig. 2.

It is admitted that the weighing of coke at each of the different points where it is used adds to labour costs, and it is true that a rough check can be obtained by comparing the quantity of coke sold per ton of coal carbonized, but a more accurate and constant check can be made daily by calibrating the coke hoppers and levelling off each day. By such strict daily supervision, a reduction in fuel consumption of as much as 10% has been realized.

But apart from the actual consumption of coke, its preparation and storage must be carefully supervised if losses are to be avoided. Nothing, for example, upsets the working of a producer more than a variation in the moisture and ash content of the fuel.

Regarding the former, there is a great temptation to increase apparent production, particularly with the light cokes from continuous verticals, by the easy method of excess watering. Whether or not it is prudent policy to adopt such tactics in the coke offered for sale, there is no doubt that when cold coke is used in the retort house the moisture content should be kept at the lowest possible figure.

Vertical retort coke absorbs moisture to a greater extent than is usually supposed. A test was made last winter by storing in the open samples of coke from each of the coals in use, with control samples under cover. The moisture was found to increase in each case, but the increase was much greater in the samples stored in the open than in those kept under cover. Water in coke is a useless diluent. In the producer it absorbs heat which is only partially recovered in the waste-heat boiler.

An excessive, and particularly a variable, ash content, is a more serious inconvenience in the producers. If the fusion temperature of the ash is low, it gives rise to heavy

clinker formation. The removal of clinker and ash from the fire is an expensive operation, not only in labour, but in the heat which it takes away from the producer on removal, as well as in the wastage of combustible material, which inevitably takes place during the cleaning operations. But variation in the ash content is more serious still, because, though cokes with fairly high ash content can give excellent results in producers when the conditions are known and adjustments made accordingly, any great variation causes an appreciable alteration in the quality of the producer gas, followed by variations in retort temperatures and loss of efficiency in the gas-making process.

Other things being equal, there is no doubt that the greater the intervals of time between successive cleanings—that is, disturbances of the fuel bed in the producer—the greater the efficiency. We have carried out tests to ascertain the best intervals, ranging from 8 to 48 hours, and the results obtained indicate that a critical period can be found for each different class of fuel. Two factors are practically constant with all the fuels tested. When the fuel bed is disturbed, a very serious falling off in producer gas quality takes place, whereas the quality of the gas improves the longer the fire is left undisturbed. The critical point is that at which an appreciable reduction in volume takes place due to the resistance arising from the accumulation of ash in the fuel bed, and this point determines the correct period for cleaning in each particular case. In our case we found that when the fire was cleaned at periods of less than 24 hours, there was a definite loss of efficiency.

On a small plant, where the operator has practically all retort house duties to attend to, the ashing out of a portion of the grate only at one time fits in favourably with other operations. Therefore, when one producer only is in operation, our standard practice is to ash out half the grate each 24 hours, and when working two producers, once in 48 hours.

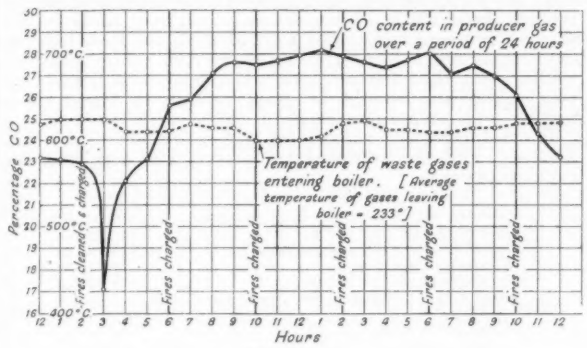


Chart No. 1.

Chart No. 1 shows the CO content of the producer gas taken over 24 hours with one producer in operation. The dotted line on the chart shows the temperature of the waste gases entering the waste-heat boiler for the same period. The line is remarkably steady and indicates fairly constant conditions, which are reflected in the steady hourly quantity of steam produced.

Recuperation and Waste-Heat Boilers.

The economies to be derived from the recovery of surplus heat from waste gases have been known to gas engineers for many years, and elaborate schemes of regeneration and recuperation have been designed and introduced in retort settings with the object of reducing the quantity of fuel required for carbonization. With the effective recovery of heat from the waste gases higher retort temperatures became possible, the mixture of producer gas and secondary air ultimately reaching a temperature at which maximum flame temperature with its accompanying economies was obtained. In arriving at this desirable end in theory many plants were weakened to an extent which made recuperation a very doubtful proposition. In many cases complicated structures with cross and transverse passages separated only by the thinnest of walls were used, the idea being to absorb the greatest amount of heat possible from the gases. These no doubt gave excellent results so long as the passages remained clear and free from flue dust and the walls free from cracks. Their design, however, tended to encourage accumulation of dust, which ultimately partially blocked up the passages and upset the working of the settings.

Again, the question of accessibility for the removal of this accumulation and the facilities for patching leaking passages were often overlooked. Regenerators formed of ordinary bricks and tiles, and probably at a much smaller cost, would have given as high an efficiency, and the removal of flue dust and repairs made while the plant was at work would have been a very simple process. In some cases it looked as though an attempt was made to transfer the entire heat of the waste gases to the secondary air, and with plants in operation to-day on which efficient recuperation is still in use the amount of steam produced after the secondary air has been heated to the fullest extent desirable shows the futility of these elaborately designed installations. It is surprising that, although waste-heat recovery in the form of steam raising has been practised in steel works for many years, this method of recovery was not introduced to any great extent into gas-works practice until after the war. Since then, however, it has made fairly rapid strides, and in practically all of the large installations of vertical retorts being erected to-day recuperation, or recovery of waste heat by transfer to the secondary air, has been entirely abandoned in favour of obtaining the maximum quantity of steam from the waste gases.

With continuous vertical retorts a slightly higher fuel consumption is required, and, particularly when low quality gas is produced, higher temperatures are necessary, and the waste gases from the setting are, therefore, proportionately hotter, and more heat is available for the generation of steam. In efficient plants it is possible to recover as much as 50% of the heat in the coke used in the producer, thus effecting a very considerable and important saving in carbonizing costs.

In the new plant at Johnstone, a waste-heat boiler of the natural draught type was installed, the size of installation being considered too small for the more efficient induced-draught equipment. Prior to the introduction of this boiler, the steam requirements of the works were supplied by two boilers—one a Lancashire and the other a Cornish—the one acting as a stand-by to the other, and this plant necessitated a fireman for each shift. Since the waste-heat boiler has been put to work, one only of these boilers has been kept under slow fire available for emergency purposes. The plant is entirely automatic in control, being fitted with the "Thermofeed" arrangement, which maintains a constant water level and is equipped with high and low water alarms.

The water evaporated per 24 hours over a test period of 7 days was 21,870 lbs., representing 3·2 lbs. of water evaporated, with a feed-water temperature of 155° F., per lb. of coke used in the producer. No additional coke is supplied to the plant with the object of increasing the steam output. As already mentioned, we are aiming at a saving in producer fuel, but it will still be true to say that the total steam requirements of the works are being supplied from what would otherwise have been waste heat.

The following statement shows the cost of steam raising before and after the waste-heat boiler was introduced.

1929-30.	£ s. d.	1932-33.	£ s. d.	1933-34.	£ s. d.
1,038 tons pearls at 11s. 3d.	583 17 6	300 tons breeze at 5s.	75 0 0	390 tons breeze at 5s.	97 10 0
47 tons coke at 22s. 6d.	52 17 6	40 tons coke at 22s. 6d.	45 0 0		
	£636 15 0		£120 0 0		£97 10 0

The cost in 1929-30 was inflated by the purchase of pearls, but even substituting breeze at half the cost, the result would still have shown a sufficient saving to justify the installation of the waste-heat boiler. In addition to the saving in fuel, the wages of at least two boiler firemen have been saved, representing approximately £300 per annum. This, added to the saving in fuel, represents approximately 1·3d. per 1,000 c.ft. of gas made.

With a waste-heat boiler, as with any other boiler, it is necessary to prevent the formation of scale, and with a vertical natural-draught boiler the elimination of any accumulated sludge is very desirable. In the large installations, water-softening plant is usually included as part of the equipment, particularly if the hardness of the feed-water is more than 3° to 4°. In a small installation the cost of this plant and its operating cost would be a fairly serious matter, and we have, therefore, resorted to the use of a mixture of caustic soda and sulphate of soda added to the feed-water to the extent of ¼ lb. of each per 1,000 gallons of water evaporated. With this arrangement we have had little or no trouble with the formation of scale. To prevent undue concentration in priming, blowing down is carried out at least once per shift. During the early period of working this boiler we had frequent trouble with tubes leaking at the inlet tube plate end of the boiler. This is attributed to the accumulation of sludge at the bottom of the boiler and the high temperature of the inlet gases causing uneven expansion. Since the boiler was retubed, for which the makers bore a part of the cost, and since the treatment of the water previously mentioned has been continuously applied, coupled with systematic blowing down, the boiler has behaved in an excellent manner. The tubes are cleaned every six weeks with a "Skattlescale" tube cleaner, and the inside of the boiler cleaned and washed out every six months. Shutting down, cleaning,

and putting to work normally takes three days, and when the boiler is going back to work, it takes about three hours to raise a steam pressure of 75 lbs. per sq. in.

The undernoted are some test figures taken from our plant:

	°F.
Temperature of water at inlet of water heater	68
,, ,, ,, ,, outlet ,, ,,	155
Rise in water temperature	87
Average temperature of steam	235
,, ,, ,, inlet waste gases	620
,, ,, ,, outlet ,, ,,	237
Analysis of waste gases—	
CO_2	19·6%
CO	0·2,,
O	*Nil*

—	Galls. Water per 24 Hours.	Lbs. Steam per 24 Hours.	Lbs. Coke per 24 Hours.	Lbs. Steam per Lb. of Coke.
1st day	2,300	23,000	6,270	3·66
2nd ,,	2,010	20,100	7,168	2·80
3rd ,,	2,200	22,000	6,944	3·17
4th ,,	2,330	23,300	6,944	3·36
5th ,,	2,320	23,200	6,944	3·34
6th ,,	2,100	21,000	7,392	2·84
7th ,,	2,050	20,500	6,270	3·27
Average	2,187	21,870	6,847	3·21

Flexibility of Plant.

At Johnstone it is frequently necessary to increase or decrease the amount of gas produced to meet with an increasing or decreasing load. With a small number of large retorts, the 50 in. model being adopted, it might be thought that the flexibility of the plant would be somewhat limited and that a wider range would have been obtainable with a

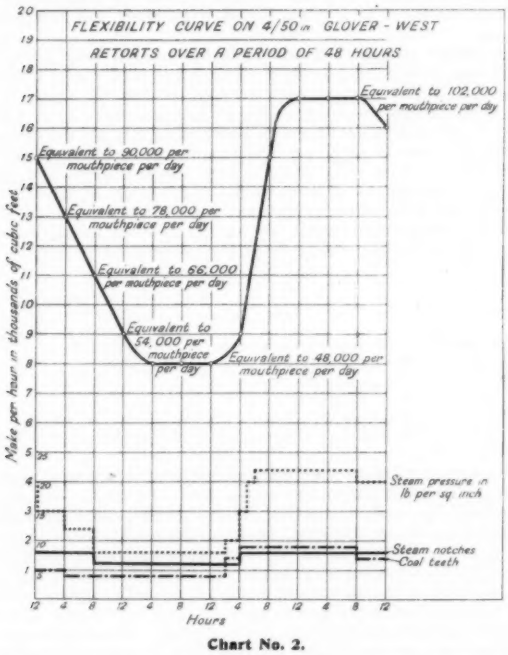

FLEXIBILITY CURVE ON 4/50 in GLOVER - WEST
RETORTS OVER A PERIOD OF 48 HOURS
Equivalent to 102,000 per mouthpiece per day
Equivalent to 90,000 per mouthpiece per day
Equivalent to 78,000 per mouthpiece per day
Equivalent to 66,000 per mouthpiece per day
Equivalent to 54,000 per mouthpiece per day
Equivalent to 48,000 per mouthpiece per day
Make per hour in thousands of cubic feet
Steam pressure in lb per sq inch
Steam notches
Coal teeth
Hours

Chart No. 2.

greater number of small retorts. Chart No. 2 illustrates the range over which it is possible to vary the production of gas without materially affecting the efficiency of the plant. The quality of gas was maintained throughout the period of 48 hours between 420 and 431 B.Th.U. per c.ft., which demonstrates a flexibility equal to that obtainable from the smaller units. The throughput of the retorts can be readily speeded up with an increased output from the plant, and by slowing down the extractor gear the output can again be reduced within a very few hours. The calorific value can be varied equally easily by reducing or increasing the percentage of steam, and these adjustments give vertical retorts a flexibility which make this type of plant suitable for any size of works.

Plant Operation.

One of the principal advantages of vertical retorts for a small works is the small amount of labour which is required to work the plant. The duties are scheduled to time table, which are as follows:

Rod and charge retorts every hour.
Inspect gauges and boilers every hour.
Discharge coke from retorts every two hours.
Elevate coal once per day.
Clean producers once every 48 hours.

The entire plant could be operated by one man; but a second man is employed, because it is considered risky to leave the plant with one man only for any length of time. The additional man assists in the various retort operations and does other duties throughout the works, and his wages, for convenience, have been allocated to carbonizing.

Following are the results from the carbonizing plant for the past two years. The figures for 1929-30 shown alongside are from the Wilson vertical retorts.

—	1929-30.	1932-33.	1933-34.
Gas made, c.ft.	141,715,000	143,190,000	146,142,000
Coal used, tons	7,214	6,888	6,969
Coke sold, tons	2,691	2,049	2,229
Coke used in producer, tons	1,520	1,643	1,462
Gas made per ton, c.ft.	19,645	20,788	20,970
Calorific value, B.Th.U. gross	424	425·5	423
Therms per ton	83·29	88·45	88·70
Coke sold in cwt.	7·46	5·95	6·39
Coke used per 100 lbs. coal carbd.	21·07	23·85	20·98
Tar sold in galls.	112,490	144,893	146,400
Tar sold per ton of coal carbd.	15·59	21·04	21·01
Carbonizing wages	£1,698	£1,239	£1,180
,, ,, per 1,000 c.ft.	2 87d.	2·07d.	1·94d.
,, ,, per therm	0·68d.	0·49d.	0·46d.

The reduction in carbonizing wages obtained by the introduction of Glover-West verticals is entirely due to the cleaning of producers and the elevating of the coal being done by the stokers, who have now fewer retorts to look after.

Maintenance Cost of Carbonizing Plant.

The entire plant has now been in operation for nearly four years, during which time some 24,500 tons of coal have been carbonized; and up to the time of writing the repairs have all been minor ones. The retorts are at present showing very little sign of wear, and no leaks of any consequence have appeared. From observation it would seem that the refractory material is still in every way sound and should be good enough to stand for a further long period of service.

The total cost of repairs on the entire plant has been £423 8s., and the following table gives the details of the expenditure:

	£	s.	d.
Re-lining of two producers at £7 10s. each	15	0	0
Coke discharge door joints	12	5	0
Repair to coke chute for producers	10	0	0
Wheels for coke bogey	2	7	6
Regrouting of top of bench	8	0	0
Repairs to lift, including new ropes, gates, and maintenance fee	37	18	6
Repair to lift motor	4	13	5
Conveyor repairs	136	0	0
Overhaul of extractor engines	12	0	0
New belts for extractor engines	2	3	7
Repacking of pumps, say	3	0	0
Re-tubing waste-heat boiler (part cost)	40	0	0
Allow for repairs to retorts at £35 per annum	140	0	0
	£423	8	0

The total expenditure of £423 8s. gives an average maintenance charge on the plant 4·148d. per ton of coal carbonized and compares very favourably with the figure of 4·5d. per ton of coal given by Mr. T. Campbell Finlayson for maintenance charges for plants using Scotch coals in a paper read before the Midland Junior Gas Association. [See "GAS JOURNAL" for Jan. 17, 1934, p. 148.]

In conclusion, I desire to tender my thanks for the opportunity afforded me to read this paper and trust the members will have found something of interest in the contribution and discussion.

Discussion.

Mr. GEORGE BRAIDWOOD (Coatbridge) said that Mr. Jamieson in discussing the standardization of calorific values had wisely decided that under present manufacturing conditions the correct calorific value was that which could be manufactured most cheaply, and he also said they could not afford to make any but the cheapest possible gas. This meant that they must still have "Qualities for Localities." What they required to-day was a standard gas unit to assist in the competitive selling of our product. They already had a Standard Therm, and he would suggest that undertakings be left alone to manufacture that therm in a manner best suited to their plant and locality. Standardization, at least in carbonization, meant strangulation. Mr. Jamieson complained that the development of price scales was not proceeding as quickly as could be wished and regretted that a strong lead had not been given the Industry by the National Gas Council. He thought he was rather hard on the National Gas Council in view of the fact that sliding scale companies could not conveniently enter into special contracts with their consumers before Oct. 1, 1934.

On the other hand, municipal undertakings, who were not supposed to make profits, had been free to charge for gas by any method they cared to choose. With such a free hand

municipal engineers should now be in a position to give the National Gas Council and also the Statutory Companies a lead. As the National Gas Council did not sell gas themselves, they could only retail the experiences of others, and that had been done very fully in the case of the working of the Rotherham two-part tariff.

Incidentally, the Rotherham commodity rate was 2d. per therm, and only two undertakings in Britain, one English, one Scottish, could put gas into their holders at less than that figure. Modesty forbade him from mentioning the name of the Scottish undertaking which did so. Mr. Jamieson gave some valuable information about the economies effected by the use of surplus heat in steam raising at Johnstone. He was a little disappointed, however, with the temperature of 155° F. attained in his boiler feed water. By harnessing the exhaust steam from pumps, engines, &c., a feed water temperature of 198° F. was being easily obtained at Coatbridge. Where water was dear, as it was with him (the speaker), over a million gallons of water per annum was condensed out by the feed water heater and was worth recovering. By the use of an oil separator the bulk of the cylinder oil used could also be recovered. The total cost of such an installation need not exceed £100. Mr. Jamieson tentatively suggests a quality of 400 B.Th.U. per c.ft. gross as a value for coals available in Scotland, where, in his view, a poor residual market made steaming advisable.

Ready to Assist.

Mr. W. Ross Taylor, M.P., said that he was glad of Mr. Braidwood's support for the National Gas Council, as he thought Mr. Jamieson was a little unfair. The Council was always ready to assist individual undertakings, but it was essential that the local conditions should be known, as it was impossible to formulate any national scheme. Many undertakings had received advice, and any undertaking desiring to do so had only to write to Mr. Fottrell.

Mr. J. Wilson (Dundee) said that in the results of the tests which were given no mention had been made of tar and liquor. He thought that that omission might be due to the difficulty in measurement, but the volatile matter (3·2-3·5%) left in the coke was fairly high, and he wondered if this was intentional. The comparison of the old and the new plant was, in a way, not strictly fair, as the old plant could scarcely be considered to be still in its prime.

Mr. D. Fulton (Helensburgh) said that the standardization of calorific value was beautiful in theory but impracticable. This was again a matter of geography; coals differed and plant conditions varied. He was pleased that the waste heat recovery was proving so successful in Johnstone, but wondered if it were possible to rely entirely on a waste-heat boiler for the total steam requirements.

Mr. A. S. Nisbet (Paisley) said that he did not think that it was altogether a good thing to have only one supply of coal, as it might happen that this coal could not be obtained at an economic price; he thought it safer to have several sources of supply. He had fitted two waste-heat boilers at Paisley, and for the last twelve years they had not given him any trouble.

Mr. R. Keillor (Greenock) said that the low feed water temperature probably meant that Mr. Jamieson was saving the exhaust steam somewhere else. He felt that it would have been of more value if the grading of the coal instead of that of the coke had been given.

The Author's Reply.

Mr. Jamieson, in reply, said that quality was an old point of discussion with Mr. Braidwood. He was supplying gas of 420 B.Th.U. at Johnstone, but he still maintained that standardization would be a good thing. As regards the temperature of his waste-heat boiler feed water, he said that he used only the exhaust steam from one small extractor engine. He had not meant to be hard on the National Gas Council, as he had already received assistance from them. He found it almost impossible to measure the tar and liquor, and the volatile matter in the coke was left there intentionally, as he found that he could get a market for coke which kindled readily. He always kept a Lancashire boiler as a standby to the waste-heat boiler; and he agreed with Mr. Nisbet that it was great advantage to have three supplies of coal.

Town Gas for Steam Raising

By David Morton, M.Inst.Gas E., Engineer and Manager, Arbroath Gas Department

[Paper presented at the North British Association of Gas Managers, Sept. 6, 1934.]

In appearing before you to-day with this short paper, it would be idle for me to begin by apologizing for its brevity, or give as a reason the want of time available for its preparation. Suffice it to say that, simple as the title is, the paper itself may be found still simpler, and the only motive which has actuated me in laying my few remarks before you is the desire to contribute, even in a small degree, to the usefulness of our Association, and to show my appreciation to the respected member of our profession who is, this year, our President.

In a recent development of our industrial load, a scheme has been carried through, whereby a large dry back marine boiler, 8 ft. 6 in. diameter by 10 ft. long, has been converted to gaseous firing, and is employed heating a large range of greenhouses erected for the cultivation of tomatoes, chrysanthemums, &c. The boiler, which is in a new condition, was purchased second-hand by its present owners, and was converted to gaseous firing by fitting radiant low-pressure gas burners complete with thermostat control, made by Messrs. British Furnaces, Ltd., Chesterfield.

Constructional Details.

The boiler is capable of a total evaporation of about 4,750 lbs. of water per hour, from and at 212° F., and each burner is constructed capable of passing 7,000 c.ft. of gas per hour.

The gas supply is led into the boiler house through a 6-in. service pipe, and is connected to a high-capacity ordinary type of dry meter, and then the gas goes forward to the "Thermogas" control. Between the "Thermogas" and the boiler, a 5-in. distribution pipe is led with two 3-in. feeders, each complete with independent valves, which are calibrated. The general lay-out on the whole unit is practically foolproof; the gas, air, steam, and water all being interconnected one with the other, each working in relation to the other. Two balanced governors connected to the main gas supply pipe and to a fulcrum arm operate the air louvres, so that when the gas is shut off by the "Thermogas" control, these louvres close, cutting out the air intake, thus preventing a reduction of temperature when the gas supply is cut off. The unit is complete with a "Drayton" regulator operating on the steam pressure, and a "Thermofeed" water regulator controls a "Weir" feed pump. We also fitted an injector in case of the failure of the feed pump, and a connection is taken from the town main water supply, the pressure being ample to feed the boiler when steaming round about 25-30 lbs.

To ensure that the maximum efficiency is achieved through an automatically controlled boiler, it is a necessity to fix a feed water control of some description, and I need not take up your time in discussing this very important machine, as, no doubt, many of you will be conversant with this type of appliance.

It is most desirable when working this regulator with a single unit that an automatic valve should be fitted to the steam pipe running between the boiler and the feed pump. This appliance will give a fixed constant level of water at all times in the boiler, and it will be agreed that this is a great aid in maintaining the maximum efficiency, which, in turn, will mean a large saving in fuel consumed per pound of water evaporated.

The radiant burners, which operate on the principle of heat distribution by radiation instead of flame contact, provide an exceptionally economic source of heat. The air gas mixture is always perfectly proportioned, the air intakes being interconnected to the main gas supply, which acts immediately the "Thermogas" comes into operation. The gas and air being closed down simultaneously, perfect combustion is maintained at all rates on the burners, assuring high efficiency at all loads, independent of any variation of the gas pressure. The use of the multiple jet principle and the high zone of heat formed at the base of the refractory tunnels releases the heat to the furnace at a greater speed, thereby giving a greater B.Th.U. release per foot of combustion space.

It is a well-known fact among engineers that the burning of gas at low pressures to obtain high capacities is a serious problem; therefore constant pressures at the furnace jets are perhaps as important and desirable as unvarying quality. There is no need to labour this point, it being a universally accepted fact. The spud used in this improved type of radiant burner has many advantages:

(1) It consists of two pieces, a nipple screwed into the permanent position in the manifold pipe.

(2) The removable spud cap is screwed tight to the

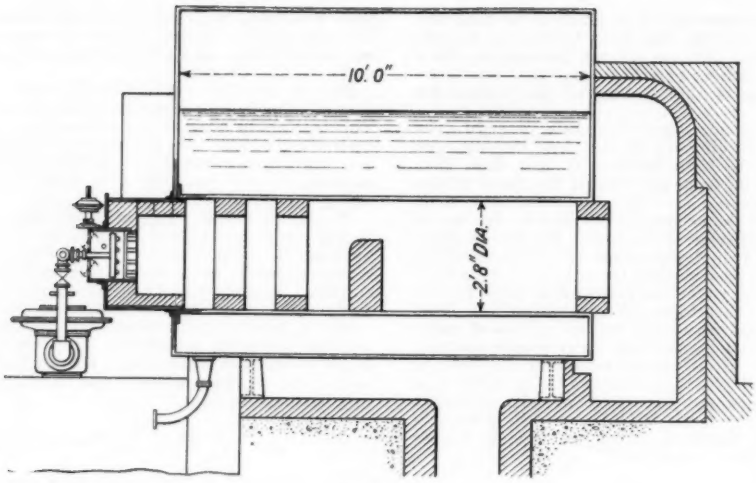


FIG. 1.

nipple finger, which allows for easy change of the size of the orifice, or for cleaning purposes.

(3) The main orifice and flare throat in the spud cap gives a method of controlling impingement of the gas in the tunnel through different gas pressures, thereby assuring combustion at a point approximately 1 in. from the face of the tunnel.

A complete mixture of gas and air is assured as well as a hot surface to aid combustion, which is further aided by the X shape of the tunnel giving a greater amount of surface for a given area.

The angle of flare also forms the gas flame into a cone, due to the tendency of the gas to follow the cool surface, which leaves a void in the centre of the cone into which air, to complete the combustion, rushes.

This unique arrangement aids considerably in the entrainment of air from the atmosphere, and ensures proper mixing of the gas and air. (See fig. 1.)

Method of Operation.

The method of control employed on this gas-heated steam boiler was of the " Drayton " type G.P.P., which is designed for controlling within close limits. It consists of a pressure operating valve working in conjunction with the diaphragm of the " Thermogas " control, the gas itself being employed as the relay medium. The regulator is simple in construction, and gives excellent service. It is most suitable for positions where no skilled attention is available, and has a great future for the control of large units, and can be employed with any thermostatically controlled appliance. The differential of the regulator is approximately ½ lb. per sq. in. at low pressure, and ¾ lb. per

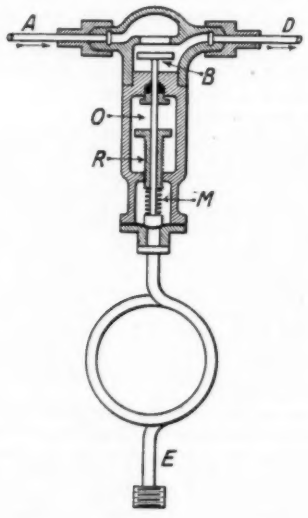


Fig. 2.

sq. in. at high pressure. The valve is suitable for high pressure or low pressure, and the pilot valve is supplied with springs suitable for any one of the five standard ranges covering 1-100 lbs. per sq. in. (See fig. 2.)

The gas enters the main valve A underneath diaphragm D, and passes through the passage G into the chamber F above the diaphragm, and then from passage I through pipe J to the pressure operating valve B. If the pilot valve is open, the gas passes freely through the unit O, where a ¼ in. copper pipe is taken from the furnace door where the gas is turned. As passage I is of a larger bore than passage G, there will be no accumulation of pressure in

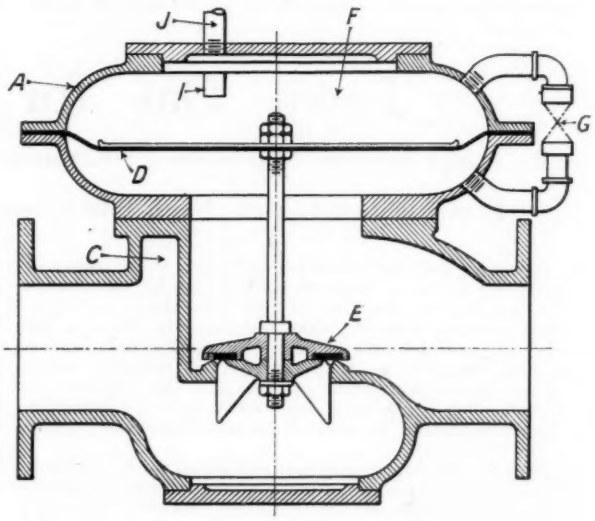


Fig. 3.

chamber F, and, the valve disc E adjusted to diaphragm D being off the valve seat, the gas will pass freely through the valve of the burner.

The boiler head pressure from the steam space of the boiler introduced through the syphon pipe connected to the pressure chamber of the pilot valve acts on the diaphragm to close the pilot valve against spring M, the resistance of which can be adjusted to any desired pressure required by adjusting spring case R on the pilot valve. The closing of the pressure in the chamber F to the main valve will balance the pressure in the space C, and the valve will close by gravity. (See fig. 3.)

The behaviour of the " Drayton " regulator gives us no concern whatever, and it is an easy matter to lift the boiler pressure from 20 lbs. to 80 lbs. per sq. in. by giving the milled nut a few turns. This operation can be done in a minute or two.

It might not be out of place to say a few words on the starting up and closing down of this large unit. It will be seen from the drawing that the by-passes are connected behind the main valve before the gas goes to the thermostat, and when the unit is to be brought into commission, it is only necessary to light the two by-pass burners with a free burning torch, which can be inserted between the louvres and up to the face of the burners. It is desirable to leave the by-pass burning for a moment to make sure that everything is in order before opening the main valves. We found it an advantage to have the main damper just slightly open until we had the gas on the main burners ignited, and

as soon as this was done, the damper could then be set, which was invariably about 2⅛ in. We found that, by adopting this method and setting the valves to allow approximately 2,300 c.ft. of gas per hour for the first twenty minutes, and then opening them to their approximate limits, the control could be left entirely to the "Thermo-gas," when full consumption would be in the region of 14,000 c.ft. per hour. (See fig. 4.)

When the unit was started upon its trial run, we found that it took us three hours and fifty minutes to bring it up from cold to carrying a head of 80 lbs. per sq. in., the consumption over that period being approximately 4,000 c.ft. of gas per hour. Incidentally I might mention that the brickwork of the unit had been dried off for several days before this.

The reason why we pushed this unit so hard its first day was that time was becoming an important consideration, as the owners were anxious to get their plants planted out, and we had yet to consider the lagging of the steam boiler along the 100 yards of 4 in. pipe, which was to be laid to the greenhouses and was still uncovered. By having the boiler under steam heat we were able to allow the boiler coverers to commence right away, and it had very remarkable results later on when we brought the boiler into commission again. That point I will deal with later.

Two days later we had all this work I have mentioned completed, and we were then ready to put gas to the boiler again. It was our intention to try to work out the thermal efficiency of the boiler, but that was not possible during this run. We commenced with a temperature of 32° F., inside the house, and were able to raise this to 85° F. in an hour and twenty minutes, the total range of the greenhouses being, approximately, 3,600 ft.

With this installation, as with many other indirect methods, two separate efficiencies have to be distinguished —the efficiency of steam generation and the efficient application of the steam in its duty of heating the water in the existing hot water system. This was improved considerably, for instance, by returning the hot condensed water from the expansion tanks to the recovery tanks, and thereafter on to the boiler feed tank, and also by the thorough lagging of the main steam pipes which were exposed to the atmosphere. The final efficiency will, of course, be the products of these two figures. When the boiler was brought into commission, we steamed round about 50 lbs. per sq. in., and, on testing the temperature of the saturated steam, we found that we had only a temperature of 278° F. When we re-set the "Drayton" regulator to cut out the burners at 23 lbs. per sq. in. we found that the temperature of our steam was 235° F., and it was finally decided, after careful observation, that there was a decided saving in gas by working at this pressure. This bore out that, by working at a higher temperature, a lower efficiency was likely to be obtained, and it also proved the importance of insulation, and of watching the flue gas losses.

Other Considerations.

Efficiency and rate of heating are, of course, not the only important factors in a steam raising appliance. In fact, in some cases, they may be entirely of secondary consideration. Some account must, therefore, be taken of such other considerations which, in this case, are as follows:

(1) The control of the atmosphere within the greenhouses.
(2) Uniformity of temperature.
(3) The reproducibility of conditions.
(4) The ease of manipulation and control, and the highest duty from the quantity of gas used.

It was very fully brought out by these observations that yet another important point required careful attention, and that was the setting of the main damper. It was surprising how often we found this point ignored by the operator, and it bore out that, in spite of everything being balanced one in relation to the other, that this damper always seemed to be entirely neglected. Finally, this was got over by boring a ⅜ in. hole and fitting a set screw, which gave us some control, although not perfect. It would therefore appear that the damper should also be controlled by some ingenious arrangement according to the quantity of gas that is being passed into the boiler. I understand that, in the latest boilers constructed for gaseous firing, this point has been carefully considered, and the flue outlet is controlled on the lines indicated. When perfect co-ordination of all these points is obtained, it will render the possibility of failure of the human element so unlikely that we may confidently anticipate the ideal gas-fired industrial boiler in all its perfections.

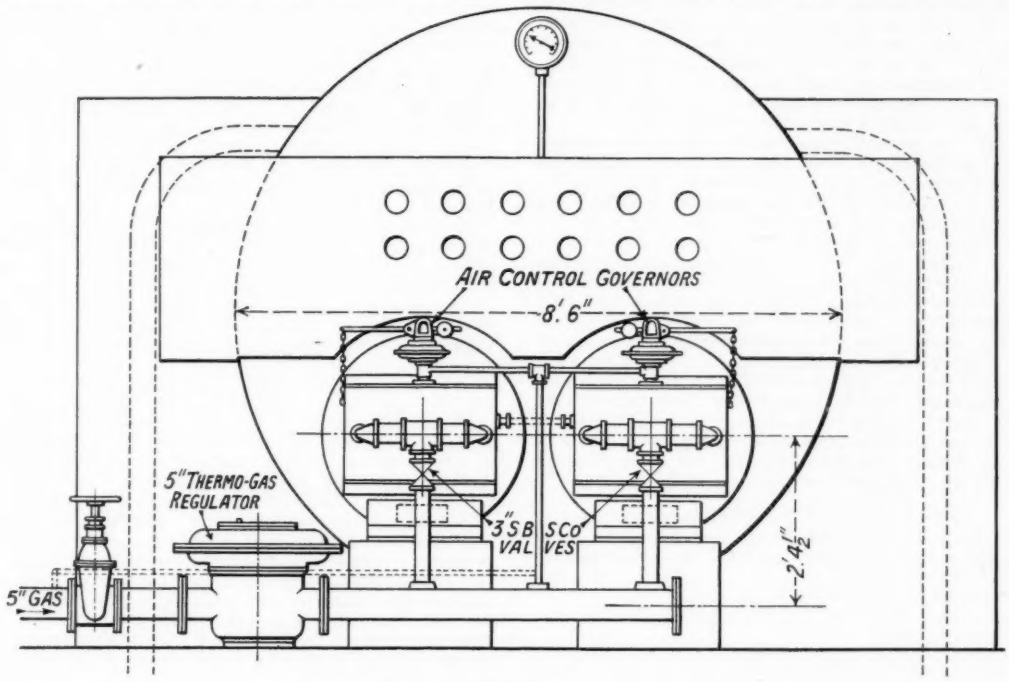


FIG. 4.

On the efficiency of a boiler for the production of steam depends, in a great degree, the utility and economical working of the unit by the person or persons responsible for its performance. There is, perhaps, nothing which leads more to inefficiency in a boiler than the want of sufficient capacity. Inequality of pressure and unnecessary waste of gas are among the common evils that will result therefrom. In regard to a sufficiency of heating surface proportionate to a boiler's capacity, or, more properly, the quantity of water that must be evaporated in a given time, there is still much difference of opinion; but no doubt much of this is due to not being explicit enough in distinguishing between the amount of horizontal and vertical or side surface of the boiler flues.

I should like to emphasize this point quite clearly—do not for one minute think that any boiler can be converted to gaseous firing, or disappointment will have to be faced when searching for high efficiencies. In building in a boiler for solid fuel, ample allowance for excess air has to be made to permit of the solid fuel being always kept at a kindling temperature. Fig. 4 shows that, in the setting arranged for gaseous fuel, this factor is carefully guarded against, both in the flues and combustion cham-

ber, with the result that high efficiencies may be expected, and have been achieved.

Heating of Greenhouses.

The steam from the boiler is taken into the greenhouse nearest to the boiler house through a 4-in. malleable iron pipe, and a control valve is fitted 3 ft. from the floor level. This live pipe is carried to the extreme end of the greenhouses with two purposes in view—first, to make use of the radiant heat available, and, secondly, to reach the highest point, in order that there may be no difficulty with the hot water circulation, and to make use of the existing expansion arrangements. Before the introduction of steam, the whole range of greenhouses had been heated by six low-pressure boilers, which were put out of commission, the flow and return pipes being cut and dumb ends fitted. A specially made " Y " piece is fitted to ensure that there is no disturbing noise from the injectors. The injectors are arranged with screw down valves, complete with the usual quick-made rubber joint, easily removable for cleaning out—and we found this very necessary, due to the old system not being drained often enough, with the result that, when we injected live steam into the water pipes, the accumulation of sludge, &c., at the injectors gave us constant trouble, until, finally, it was arranged to have a thorough clean out of the whole system. Realizing that serious consequences might arise in the event of the steam having to be shut down, seeing that all the plants had been planted out, auxiliaries were fixed at different points on the flow pipe. These auxiliaries consisted of ordinary 4-in. saddle pieces, clamped on, and having a ½-in. hole connected by a ½-in. iron pipe to the 4-in. steam pipe, with ordinary ½-in. steam valve as a means of control.

These auxiliaries proved very handy, especially during the cold spell in February, and gave us the advantage of balancing up the heat at any point desired. Once the injector valves were set, we found this ample to maintain the heat during the day, and by careful observation of the thermometers, we were able to adjust the auxiliaries to be left working during the night. The existing expansion tanks in the houses were used as recovery tanks, for when the steam had been condensed back to water, and had given up most of its sensible heat, we had to make provision for large quantities of hot water being driven out of the heating system. These tanks were connected by 1-in. iron pipes back to the boiler feed tank, which was the source of water supply to feed the boiler. On testing this water on its return to the boiler house it had a temperature of 58° F., which helped to obtain a high thermal efficiency for the boiler. In point of fact, we were able to evaporate 1 lb. of water per 3 c.ft. of gas consumed.

Test for Water Evaporation.

Evaporation per lb. of water at 58° F. (feed water temperature).
Temperature of saturated steam . 235° F. at 23 lbs. per sq.in. pressure.
Latent heat of steam (949·2) . . . . . ,, ,, ,,

(235° F. − 58° F.) + 949·2.

177
949·2

1,126·2 B.Th.U. per lb.

$$\therefore \text{ Efficiency of boiler} = \frac{1{,}126{\cdot}2}{1{,}350} = 83{\cdot}42\%$$

Boiler Efficiency.

On a test being made for boiler efficiency, the following are the results:

Duration of test	2 hours
Gas consumed	9,700 c.ft.
Calorific value	450 B.Th.U. per c.ft.
Input to boiler by gas . . .	2,315,000 B.Th.U.
Boilet output by steam	1,931,173 ,,
Boiler, steam pipe, and condensed water loss	383,827 ,,
Total heat absorbed by boiler . .	1,925 023 ,,
Actual B.Th.U. output by boiler .	1,651,269 ,,
Boiler efficiency	83·42 %

Analysis of Gas at Base of Chimney.

CO_2	11·2%
CO	0·0 ,,
O	3·3 ,,

Gas as a Substitute for Coal.

A steam boiler consuming coal can be a very inefficient unit in the hands of an incompetent fireman, and may fall far below the ordinary desired standards; but it can only reach a certain minimum level of efficiency, and then it will cease to function altogether. Coal is, in fact, of such a nature that it will quietly stand a certain definite loss in economic results, and then it will quit. With gas, there is no limit to the possible wastefulness that may exist. Give gas badly constructed burners, improper furnace construction and conditions, excessive chimney draught, and neglect the many other important details, and it will still roar and waste itself away, but it will never give up, and the waste heat may be so great that the boiler will not produce sufficient steam to drive the feed pump. It is approximately true that 50 c.ft. of 450 B.Th.U. gas equals 1½ lbs. of coal in actual steam raising results. Roughly, this is equivalent to saying that 336 therms of gas equal one ton of coal.

A very reliable rule which may be considered approximately correct is that when the price of gas in pence per therm is double the price of coal per ton, the cost of fuel for producing a certain boiler capacity will be the same for both. Thus 5d. worth of gas equals 2½d. worth of coal. This rule takes into consideration the probable increased boiler efficiency obtainable by a gas-fired boiler, but makes certain assumptions concerning the heating values of the two fuels under consideration—for instance, the specific gravity and calorific value of the gas and the quality of the coal used, while generally representative, may or may not be correct in any specific instance. Reliable tests have shown that the gas-fired boiler (*i.e.*, the percentage of heat units in the gas which is actually absorbed by the steam leaving the boiler) may be as high as 91%, although 77 to 83%, or even 75%, may be considered very good under regular operating conditions.

With coal as a fuel, while we often read of efficiencies round about 80%, they are seldom achieved, because I am certain that, before such high results can be obtained with coal very large units must be employed, equipped with the most modern and efficient mechanical stokers. Certain it is that with hand-fired boilers, 65% is about the maximum, while 55% may be considered very good average work. The advantage possessed by gas in respect of increased boiler efficiency is due primarily to the perfect combustion conditions that are obtainable, due to having the increment of air under absolute control, while with coal hand-fired boilers, air in excess of the theoretical amount may show 50%, and good everyday working conditions may run as high as 80 to 90%.

It is an acknowledged fact that the more even the rate of fuel consumption the more readily will fuel saving be effected. A steam-raising unit such as I have described, fitted with its various appliances to ensure perfect control, opens up a new avenue for the sale of gas in large quantities for industrial purposes. How far we can develop this load will greatly depend upon the selling price of the gas.

Price of Gas.

We have come to a very important consideration when we have to offer a rate competitive with other fuels, for the development of the use of gas for industrial purposes. In Arbroath, perhaps, we are still a trifle old-fashioned in that we still adhere, strictly speaking, to the original flat rate. This may or may not be due to the fact that our price to ordinary consumers is a low one. The question which occupies a great many of our minds at present—namely, the introduction of tariffs, block rates, and sliding scales—has been carefully examined, but, so far, nothing has been done to introduce this method of charging. Perhaps it is our low capital burdens and our high consumption per consumer that makes us carry on with our existing rates, which are as follows:

6·6d.	per therm to ordinary consumers						
6·1d.	,,	for industrial purposes using up to				1,125 therms	
5·5d.	,,	,,	,,	,,	,,	above	1,125 ,,
4·5d.	,,	,,	,,	,,	,,	up to	15,750 ,,
3·74d.	,,	,,	,,	,,	,,	above	15,750 ,,

The charge of 6·6d. per therm is subject to a discount of 7½% for outputs in excess of 3,375 therms.

The last two rates were introduced recently to counteract oil competition in our district; and I could not anticipate securing any new business, or holding what business we already had, unless the selling price of gas for industrial purposes was brought into closer line with the price of oil—which is quoted at 4½d. per gallon. After due consideration, we finally agreed to offer a supply of gas on a contract basis to our prospective new consumers at 4·5d. per therm, and after they had taken a specific quantity of gas, this rate was to be brought down to 3·74d. per therm.

The agreement, which is as follows, may be of interest:

> MINUTE OF AGREEMENT between the Provost, Magistrates, and Councillors of the Royal Burgh of Arbroath, hereinafter called the first parties, and Messrs. ——— Tomato and Fruit Growers, Arbroath, hereinafter called the second parties.
>
> WHEREAS the parties hereto have entered into negotiations for a bulk supply of gas to be provided by the first parties to the second parties. Therefore the parties hereto have agreed and do hereby agree as follows:
>
> *First.*—The First Parties do hereby undertake to supply the Second Parties with all the gas they require for steriliza-

tion purposes and for heating the greenhouses at ——— belonging to the Second Parties on the following conditions —viz., the boiler pressure shall not exceed 60 lbs. per sq. in. and the time of the steam at the grid shall not exceed fifteen minutes.

Second.—The Second Parties shall pay to the First Parties a minimum sum of THREE HUNDRED POUNDS per annum. In return for this sum, the First Parties shall provide the Second Parties with 3,550,000 c.ft. of gas of the calorific value of 450 B.Th.U. gross per c.ft. In the event of the consumption during the year being less than 3,550,000 c.ft., no rebate will be allowed for the said sum of THREE HUNDRED POUNDS.

Third.—In the event of the consumption by the Second Parties exceeding 3,550,000 c.ft. during the year, the First Parties agree to supply the quantity of gas required, in excess of that amount, at the price of 3·74d. per therm, which is equivalent to 1s. 4·83d. per 1,000 c.ft.

Fourth.—This agreement will remain in force for the period of twelve months from the date on which the supply of gas is first utilized on the premises by the Second Parties: IN WITNESS WHEREOF these presents typewritten on this page of stamped paper are executed as follows—viz., By ——— all fruit growers, Arbroath, the individual partners of the said firm of ———, and by the said ——— (the signature of the said firm being adhibited by the said ———) all at Arbroath on the twentieth day of November, Nineteen Hundred and Thirty-Three, before these witnesses ——— Clerk, and ——— apprentice, both to ——— Solicitors, before the Supreme Courts of Scotland, Arbroath; and by the said Provost, Magistrates, and Councillors at a meeting held by them at Arbroath on the eleventh day of December and year last mentioned by being subscribed by ——— Provost, and by ——— Town Clerk, both of the said Burgh, and sealed with the Common Seal of the said Burgh, all before these witnesses ——— Clerk, and ——— Typist, both in the Town Clerk's Office, Arbroath.

To satisfy ourselves that we were on the right lines with regard to the price of gas, and to make sure that we were protecting ourselves, as well as our new large consumer, I took the opportunity of discussing this matter further with a representative of the Board of Agriculture, and our discussion on greenhouses in Scotland generally was most interesting and instructive. The Board of Agriculture compute all their calculations on the basis that 2,804 ft. run of glass is deemed to be one acre. It is general in Scotland for fruit growers to consume approximately twelve tons of coal per 100 ft. of glass heated. If one considers these figures, it is clear that the development of gas for this particular purpose will mean a great deal to the Gas Industry in Scotland, particularly in the Lanarkshire area; and I believe that a gas syndicate has been formed in that area to meet these requirements.

I have no doubt, as already indicated, that the " power weapon " will be the price of gas. The development of the sale of industrial gas on the lines I have indicated opens up a field which we have not yet tackled seriously. When one considers that the bulk of the fruit growers' gas requirements is taken during the night, the price must be cut to very fine limits, particularly as the load, in the earlier stages of cultivation, is practically steady. This may be regarded as an admirable spring load, just as we are coming off our maximum winter load and making preparations for slowing down on the approach of summer. To supply this gas resolves itself into the net cost into holders—*i.e.*, the cost of coals, stokers' wages, less residuals, *plus* the proportion of standing charges. And therein lies the snag. What is the correct proportion of fixed charges we must add, if we have to tackle the problem of selling cheap, competitive industrial gas?

One Consumer Only.

Manufacturing charges, which I have analyzed with regard to gas-works in Scotland only, bear out that we all get our gas into the holder, practically speaking, at the same price. It is the cost of distribution, *plus* other charges, that make up the differences in actual charges to consumers. This brings us back to the old consideration: Why should we not regard our large consumers as one consumer only, demanding three meter readings per year, with one service and one meter to maintain, and taking large quantities of gas which must be sold as close to the manufacturing charge as possible? When one considers the generally accepted practice in modern gas-works of keeping a retort or two in readiness for the day that never arrives, a night load is something we would be all glad to have, and, further, it is our duty to do our very best to develop this load, and once having it, to keep it.

Frankly, whether we shall be able to retain this large consumer is a big problem, as we have been approached recently for a further reduction in price; but when one considers the amount of money expended, for instance, in running a 6-in. service pipe, *plus* the cost of a high-capacity meter—a portion of which must be borne by the new consumer—it makes it nearly impossible to get down below 3·74d. per therm. I have to make a clean breast of it. We were offered a sum of £600 to grow the crop, and, after careful consideration—although this figure would have been ample—I was not prepared to allow any of our consumers to have an unlimited supply of gas for a given amount, even in spite of the attraction of retaining this concern as a consumer. Unfortunately, no credit has been given by them to the saving of wages in general, for stoking, reduction in initial cost of installation, absolute control of temperature within the houses, and more especially to the fact that disease throughout the houses was practically unknown. When one realizes that operation under these ideal conditions enables fruit growers to have products ready weeks ahead of any other in the district—and when they are producing large quantities of fruit which sell at top prices—one can hardly appreciate why the cost of gas should again have to be considered. The main crop has been grown and sold, and I am hoping that, when the day arrives for them to take out a final balance-sheet, they will agree that gas has served them well and that we shall be in a position to regard them as one of our established consumers.

In conclusion, let me say that these few words I have written are in the hope that they may be of interest, and that they may help all of us to develop a new outlet for our product. We read so much these days about the ultimate fate of the Gas Industry that one sometimes asks oneself if there is a way out of the darkness into which many would seem to think the Gas Industry in Scotland has fallen. We all have our perplexities to face in our everyday life, and many of us are losing business in face of keen oil and electrical competition, but the troubles that beset us as an ally to industry and a servant of mankind are large, and concern things fundamental. But let us take heart again, for these days of unjust competition are nearly past, and, as our President has reminded us, things will be different when the grid finally comes into operation at the end of 1936, when profits will have to be earned to work out their own salvation; and to earn profits, it is a significant fact that the selling price of their commodity will have to be increased considerably.

With regard to oil, this was corrected some time ago by the introduction of 1d. per gallon tax, primarily to assist the coal industry, but which has had marked results in helping the Gas Industry to retain present industrial business, and has opened up a new avenue for the sale of industrial gas. On the whole, I do not look forward to an immediate close down of any gas-works if only those responsible for dictating and carrying out the future policy of their concerns keep modern methods and a progressive policy always before them, bearing in mind that the days of high-priced gas, coupled with big dividends, are gone for ever. To say that we are drifting towards a crisis of serious magnitude is a statement which should be challenged by every gas man, and the easiest way to do this is to make gas the virile servant of mankind and industry.

Unification of National Bodies.

Some men of my acquaintance, who have dispassionately studied all the facts involved in our present situation, believe that the unification of our National Bodies might help us quicker along the road to success in the future. I noticed, recently, that an eminent Gas Engineer in Scotland favours the appointment of a Generalissimo, due to the experience we gained during the Great War; and I feel certain his decision was based upon the fact that this great venture proved the success it was, due to the fact that interference and colossal muddling was ignored by the man who knew the lie of the land, who had a progressive policy, and, finally, he won the war. The manner in which we bear ourselves under the fierce State-aided electrical competition, whatever its nature or its duration, is a matter of first importance, for no straightforward competition in business affairs entirely annihilates an industry; it leaves it either able or broken; either hoping or despairing.

In order to see how we should conduct ourselves in the difficult days ahead, let us first ask ourselves how is it we are losing so much of the business we have held so long. In my own memory, we were incomparably the most enviable industry under the sun, famous not only for our products but for practical good sense in our business relations. How is it, then, that suddenly we have come to the edge of a cliff, and that other fuel and light suppliers have the courage even to begin numbering the days of the Gas Industry? The answer to this important question is probably a simple one. There is chaos in our ways of doing things, because there is confusion in our minds regarding a future policy. There is disorder in our camp because there is discontent in our souls. We can no more hope to shape a great future out of our present way of thinking, any more than a boy can hope to catch the Loch Ness Monster by

hook and sinker. Our thoughts are our chastisement. If we let them, they will become our destruction. So long as we are thinking stupidly, our existence as a powerful Industry will stand in peril, and so long as we are not thinking sanely, vigorously, and with a stern sense of individual responsibility, we must inevitably drift towards disintegration.

Fallacies are as fatal to men and industry as errors of any kind are to the mathematician and the gas engineer. In other words, we are blundering along for want of a united progressive policy. Let us be quite clear that it is nothing outside of us which is bringing our Industry into an awkward position, but only the sloth of our own undutiful souls. By our own conduct of our business, which is the expression of our inward life, we are inviting Nemesis to stay with us, for we are acting not only as if it were possible, but reasonable, to gather grapes from thistles, and figs from thorns. If only for our Industry's sake let us quickly confront the facts of our situation, studying them as earnestly as a seaman studies a threatening sky, and then vigorously ask ourselves if we cannot find in the wisdom of our ancestors and in the whisperings of our own conscience that piece of knowledge which may save us.

Finally, you will agree with me that I have not spoken too strongly when we remember all we owe to Murdoch, Young, Watt, and all the other great pioneers of our Industry. The day has arrived when the Gas Industry, along with its allied industries, could, as a whole, with profit, consider seriously the words: "Vigilando Munio."

Let us, then, be up and doing,
With a heart for any fate;
Still achieving, still pursuing,
Learn to labour and to wait.

Discussion.

Mr. W. Ross Taylor (M.P. for Woodbridge, Suffolk, and a member of the National Gas Council) congratulated Mr. Morton on his paper and said that he was very pleased to have this opportunity to comment on the legislative side of the Industry. From his Parliamentary experience he knew how the Government regarded gas and realized how little some of the members knew about it. There were many difficulties, but these could be got over if gas spoke with a united voice. The National Gas Council would speak as the Industry dictated. In Scotland they were very fortunate in having an organization like the North British Association which could inform the National Council what the Industry wanted. In the case of the Gas Undertakings Bill, the Council had discussed the position of the small undertakings with the Board of Trade authorities who wished to impose statutory control on these concerns. The Council, however, pointed out that these undertakings were working amicably with their local authorities, and the Board of Trade and the Scottish Office gave way. This was achieved by the Industry speaking with a single voice, and the national voice was that of the National Gas Council. It was most important that gas undertakings, many of which were passing through hard times, should support the national bodies financially. The subscriptions should be brought up to a high level, and they must show a united front to electrical competition.

Mr. J. Wilson (Dundee) commented upon the steam temperature, which was given as 278° F. at 50 lbs. pressure, whereas steam saturated at this pressure had a temperature of 290° F. He also thought that the analysis of the gas at the base of the chimney would have been better.

Mr. D. Fulton (Helensburgh) said that he had reached the same conclusions as Mr. Morton, but he considered that the final portion of the paper was tangential to the subject. The Gas Industry did not deserve this castigation. The words were strong, and he was sure that Mr. Morton was mistaken as to the position of the Industry.

The Author's Reply.

Mr. Morton replied that, in spite of what had been said about the conclusion of his paper, he felt that he had done something when he had induced a representative of the National Gas Council to comment on it. He agreed with Mr. Ross Taylor that there was room for both gas and electricity, provided they presented a united front. The temperatures of steam which he had given were those actually obtained. He had experienced difficulty in measuring these temperatures, and the figures given were obtained inside the greenhouse at the control valve. The analysis of the gas was another problem which presented difficulty, as the shaft was 30 ft., and he had no elaborate measuring instruments. As regards Mr. Fulton's criticism, he said that these were his convictions and he would stick to them. Something had to be done to get Scotland out of the awkward position it was in. In his district all-gas houses had been erected, and a representative from Edinburgh had expressed disappointment that only gas had been installed. He wondered why this should be, and suggested that, in some quarters, it was the opinion that the day of gas had passed. The Gas Industry should have someone of authority to point out and correct these mistaken views.

Notes on Plant and Processes

Some Recent Cutler Gasholder Contracts.

We learn that the Brighton, Hove, and Worthing Gas Company have placed an order with Messrs. Saml. Cutler & Sons, Ltd., for a new 4-lift guide-framed gasholder at their Blackrock Station following upon the completion of one by the same firm at their Worthing Works.

The greatly improved railway service provided between London and Brighton is bringing that popular resort into increasing favour as a residential district, and the Gas Company is fully keeping pace with the times, not only in its service to customers but also in preserving the amenities of the districts in which their works are situated. The new gasholder at Blackrock will have a latticed steel guide-frame of the "Paddon" type, which is both pleasing in appearance and of adequate strength for resisting the heavy winter gales sometimes experienced at this rather exposed station.

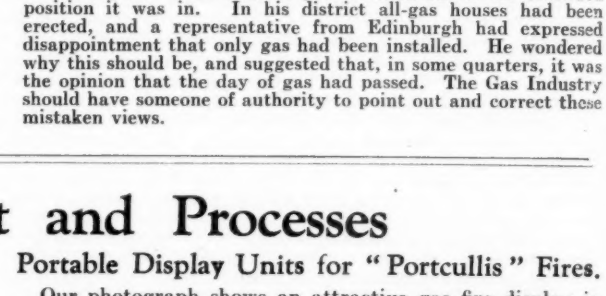
Messrs. Cutler are also busy with considerable gasholder contracts for the Hong Kong and China Gas Company, including a new 500,000-c.ft. holder with Cutler triangulated guide-framing and steel tank at Kowloon, and extensive reconstructions and additions at the West Point Works at Hong Kong.

They have also recently completed 2 new gasholders for the Shanghai Gas Company, one of 750,000 c.ft. capacity in steel tank and another of similar design but smaller capacity, as well as repairs to a large existing gasholder. Messrs. Cutler have had a large share in the world's gasholder construction over a period of 80 years and were pioneers in the building of those of large capacity both at home and abroad. Twin gasholders, each of 6¼ million c.ft. capacity, were constructed by them as far back as 1883 for the Birmingham Corporation, followed by others of 8 million capacity in London and Sheffield and 5 million capacity in Vienna and Berlin; also the largest in Rome, Turin, and many other places abroad are of their construction.

Although post-war conditions have severely curtailed the opportunities of British manufacturers in regard to foreign work of this kind, it is gratifying to note that Messrs. Cutler continue to take leading rank as gasholder constructors both in the home and foreign markets.

Portable Display Units for "Portcullis" Fires.

Our photograph shows an attractive gas fire display in the Purley Showrooms of the Croydon Gas Company, depicting some of the "Portcullis" models manufactured by Messrs. Bratt, Colbran, & Co., and the Heaped Fire Company, Ltd., of 10, Mortimer Street, W. 1.



"Portcullis" Display at Purley.

An interesting feature of this display is the fact that the painted wooden surround units are so constructed that they are easily portable and can be removed as a whole from one showroom to another, while other fires or complete fireplaces may be substituted as desired. This enables an undertaking to build up an effective display which can be readily changed from time to time without structural alterations to existing walls and panelling.

Collection and Distribution of Gas in Bulk

From a Paper by Dr. C. H. LANDER, C.B.E., Professor of Engineering at the Imperial College of Science, and Dr. E. W. SMITH, C.B.E., Technical Director of the Woodall-Duckham Companies, presented at the British Association Meeting in Aberdeen.

The great interest aroused during recent years in the distribution of electricity to the whole country by means of the grid system has naturally suggested to the public whether other commodities, notably water or gas, may not be dealt with in a similar manner. Electricity and gas distribution are allied in that both are methods of distributing energy which in this country is mainly derived from our coal resources. Different factors, however, govern their economic distribution. The generation of electricity gives rise to no bye-products. In addition, electrical energy may be transmitted economically over longer distances. On the other hand, in the case of gas distribution actual matter—whether in the form of gas, coke, or tar—has to be distributed to the centre of utilization, and the question arises whether it is better to transport it in the form of trucks of coal to the consuming centre and to treat it there, or whether it will be cheaper to generate gas in some district centre and then to pipe the gas to local centres of distribution. In some districts, however, a special factor has to be taken into account, inasmuch as large quantities of coal are carbonized to make coke for use in the metallurgical industries. In these cases gas is a bye-product. Some of the gas may be consumed for industrial purposes on the spot, but there is still a large surplus which in some cases is simply burnt to waste. In districts not too far from such centres it pays to pipe coke oven gas over moderate distances for distribution for domestic and industrial purposes.

It has been implied, on many occasions, that the Gas Industry in England has been backward in making use of the supplies of surplus coke oven gas which are available. This reproach is not by any means justified. No less than 34 gas undertakings are receiving part or all of the gas they sell from coke oven plants. Of these undertakings 20 receive the whole of their requirements from coke ovens.

The quantity of gas bought by gas undertakings from coke oven plants amounts at the present time to upwards of 15,000 million c.ft. per annum, which is more than one-half that distributed by the Ruhr gas grid, and appreciably more than that sold through the Belgian gas grid. It is likely to be considerably augmented in the near future in various parts of the country, and particularly by the operations of the Sheffield gas grid.

The pioneer in the use of coke oven gas was the Middlesbrough Corporation gas undertaking, which for many years has been supplied entirely from this source, though at the present time the Sheffield gas undertaking is the largest buyer of coke oven gas.

The existence of these and other supplies has been brought about by the initiative of the individual gas undertakings and coke oven owners, and, generally speaking, the distances over which the coke oven gas is distributed are relatively short.

GAS DISTRIBUTION SCHEMES IN ENGLAND

It is necessary to distinguish those schemes which come within the purview of this paper from the general distribution of gas to individual consumers. Distribution as normally understood in the Gas Industry refers to the network of trunk mains and smaller mains which conveys the gas through the streets of the undertaking and to which the individual consumers' services are connected.

The gas distribution schemes which are dealt with in this paper comprise those in which large quantities of gas are conveyed from the point of manufacture to some other point where the gas can be introduced into the mains mentioned in the previous paragraph. For convenience, they may be grouped as follows:

1. Schemes for transferring bulk quantities of gas from one manufacturing station to another or to a gas-holder station.
2. Schemes for transferring bulk quantities of gas from a manufacturing station to the more remote parts of the area of supply, where they are introduced into the ordinary mains through governors.
3. Schemes for transferring bulk quantities of gas from coke ovens to gas-works.

Gas Light and Coke Company's Scheme.

A careful study of the distribution scheme of this important Gas Undertaking is of the utmost value, not only for its extent, but from the fact that it is the exemplar of what the authors conceive could be the lines of development in other parts of the country. H. J. Escreet* has described in detail the gradual development of the distribution scheme. The area at present supplied by the Gas Light and Coke Company extends from Southend on the east in a continuous zone (with the exception of a break at Romford about two miles wide) to Staines on the west, a distance of about 67 miles. The total area is now over 500 square miles. The total number of consumers is 1,440,000, and the total annual sales of gas amount to nearly 50,000 million c.ft.—*i.e.*, nearly 20% of the total gas produced in Great Britain. The heat value of this gas is equivalent to nearly one-half of the total heat equivalent of the electricity produced in this country.

The Gas Light and Coke Company is an amalgamation of a large number of gas undertakings. Since 1870 fifteen additional undertakings have been absorbed. In that year the Beckton manufacturing station was inaugurated, conveniently placed on the River Thames for expansion and for the reception of cheap coal, sea borne from Durham. The gas from Beckton was originally delivered under holder pressure of about 6 in. water gauge to their works in the City by 48 in. and 36 in. ordinary cast-iron mains.

As the area of the Company developed by the absorption of other undertakings a process of selection of manufacturing stations was commenced. Certain of the manufacturing stations of the absorbed undertakings were retained and extended or reconstructed. Others were closed down, the holders only being retained. The manufacturing capacity was replaced by connecting them to the Beckton main and increasing the manufacturing capacity at Beckton accordingly. Those manufacturing stations which were retained have also been connected to the Beckton main. Thus, the whole of the area west of Beckton is supplied partly by the gas made at the manufacturing stations, the deficiency being supplied by drawing on the Beckton main. The Beckton gas is introduced into the street mains either by filling the holders at the various holder and manufacturing stations, or directly at selected points through governors. The control of the whole system is exercised from a central point. The additional carrying capacity of the Beckton mains has been obtained by increasing the inlet pressure at Beckton to 74 in. water gauge (2¾ lbs. sq. in.). Further help in supplying the extreme western end of the district is obtained by repumping the Beckton gas at Fulham.

Superimposed on this medium pressure system are local high-pressure systems at Richmond and Woodford, while a third at Pinner is in process of construction. These systems are designed to overcome local difficulties in supply; the pressure used at Richmond is 4 lbs. per sq. in. and at Woodford 13 lbs. per sq. in., and the Pinner system is designed to use initial pressures of 11 lbs. per sq. in. In essence, the function of these local systems is the same—namely, the manufacturing stations at these three points having been closed down, the Beckton system has been extended, the gas from which is compressed and distributed for the needs of the particular district. The recent absorption of the sparsely populated district east of Beckton has brought other problems. This district as far back as 1913 was laid out with a high-pressure gas system in which pressures up to 40 lbs. per sq. in. were used. The manufacturing station was at Grays, and a number of villages extending over a considerable area were supplied by high-pressure gas. This system is somewhat different from the others already mentioned, inasmuch as individual consumers are connected directly to the high-pressure main, each consumer's premises being fitted with a suitable governor.

Of the three former manufacturing stations in this eastern territory, only one remains as such—namely,

* "Distribution at High and Medium Pressures in the Area of Supply o the Gas Light and Coke Company." "GAS JOURNAL," 1932, CXCVII. pp. 484 *et seq.*

Southend. Grays has been connected by a main about 13 miles long to Beckton, while Brentwood has been connected to the Grays high-pressure system.

Birmingham Corporation High-Pressure Distribution System.

The high-pressure gas distribution scheme in Birmingham was commenced in 1910, being one of the earliest examples in Great Britain. Its object was threefold—to aid the low-pressure mains, to enable extension of high-pressure street and shop window lighting to be carried out, and to afford a supply of industrial gas under pressure. The industries of Birmingham are peculiarly fitted for obtaining the utmost advantage of town gas supplied under pressure, and large quantities of gas are now consumed in this way. The gas supplied under high pressure is compressed to 12 to 15 lbs. per sq. in. and is taken by means of 24 in. and 16 in. mains to the centre of the city.

From this point there is laid a series of mains through the central streets and through the north-west industrial district. The gas passing through these mains is used entirely for industrial purposes and for high-pressure street and shop window lighting. This also applies to the other group of mains running independently on the north-west side of the gas-works. Midway between the gas-works and the centre of the city the main high-pressure line is tapped and a 12-in. main some 5 miles in length is taken to an important and extensive residential and industrial suburb in the south-west of the city. Here the high-pressure supply is connected to the ordinary low-pressure mains through governors, whereby the high-pressure supply is available for reinforcing the low-pressure supply when necessary. The 12-in. main is tapped at two points about a mile out from the centre of the city, whence 9 in. and 12 in. mains run west and south-east respectively for the purpose of reinforcing the low-pressure supplies to rapidly growing residential suburbs. The carrying capacity of the 12-in. reinforcing main is being increased by running a 16 in. and 12 in. main in parallel for the first 1½ miles of its length.

The total length of high-pressure mains is 29 miles, and the quantity of gas handled amounts to 650 million c.ft. per annum, of which about 40 million c.ft. are sold as high-pressure gas directly to consumers (mainly industrial), the remainder being used primarily for reinforcing the ordinary low-pressure supply.

Sheffield Gas Grid.

In the First Report of the National Fuel and Power Committee* the desirability of a survey of the possibilities of the utilization of the large volumes of surplus coke oven gas for town purposes was pointed out. A definite recommendation was made that an area lying between the Humber and Liverpool and between Leeds and Birmingham should be investigated under the auspices of the Government.

The Departmental Committee on Area Gas Supply was constituted for this purpose. After careful study of the available facts the Committee† came to the conclusion that a general scheme covering the area indicated was not justified, but proposed that a network of mains should be undertaken which would collect gas from 19 coke oven plants in the area between Barnsley and Sheffield and distribute this gas, which was estimated ultimately to reach a figure of 80 million c.ft. per day, within the Sheffield and Rotherham area. The main justification for this proposal lay in the large potential demand for gas from the iron and steel industry.

Two proposals for carrying out this recommendation have been before the Industry—namely, a gas grid owned by the coke oven owners and alternatively an extension under statutory control of the powers of the Sheffield Gas Company who already had been active in purchasing considerable quantities of coke oven gas.

The negotiations culminated in the Sheffield Gas Acts and Order of 1929 and 1934, whereby the power to collect and sell coke oven gas for domestic and industrial purposes over a considerable area has been vested in the Sheffield Gas Company.

By 1929 the Sheffield Gas Company had been connected to four coke ovens, and since that time two additional coke oven plants have been linked up. Additional mains are at the moment under construction, whereby further coking plants will deliver their surplus gas into the general network of mains.

It may be anticipated that in the near future the iron and steel industry in the Sheffield area will have an ample supply of coke oven gas at reasonable prices, the technical and economic advantages of which are undoubted.*

* Report of National Fuel and Power Committee, 1928, Cmd. 3,201. H.M. Stationery Office, p. 29. ("GAS JOURNAL," Vol. 185, p. 155.)

† Report of the Departmental Committee on Area Gas Supply, 1930. H.M. Stationery Office. ("GAS JOURNAL," Vol. 190, p. 480.)

EFFECT OF DISTRIBUTION ON CENTRALIZATION OF MANUFACTURE.

The factors which influence the decision to close a manufacturing station and to substitute a supply of gas from another are many and varied, and a complete analysis is outside the scope of this paper. In order, however, to give a correct perspective to this question, it may be advisable to make the following observations.

Contrary to the state of affairs in electricity generation, gas-making can be carried out in small units substantially as cheaply as in large units, and consequently there is not the same scope for economies in manufacture by the centralization of gas-making as there is in electricity generation. It should also be noted that, in the present organization of the Gas Industry, gas-works are producing coke as well as gas. While the question of the Gas Industry making and selling gas only is constantly under review, and in spite of certain disadvantages attendant on the selling of energy in the forms which to some extent are competitive, a clear case has not been made out for the extensive adoption of complete gasification.

The decision to close a manufacturing station must, therefore, take into account the cost of gas transmission and also the extra cost of coke transport from the new point of production. It may well be that some saving in transport of coal may result from the change; but if the extra cost of gas transmission and coke transport is greater than the savings in coal transport, the balance must be covered by the savings in manufacture cost resulting from the centralization.

At the London Conference in 1928 one of us† reviewed the relative costs of transmission of energy in the form of coal, coke, fuel oil, gas, and electricity over various distances, and showed that per therm contained in the commodity transmitted the costs lie in the order given—coal and coke giving the lowest cost. While the costs of transporting coal, coke, and oil are dependent only on the distance, those relating to gas and electricity are dependent in a considerable degree on factors other than distance. The actual quantity of gas transmitted has an important influence on the cost of transmission, while the load factor —*i.e.*, the variation from summer to winter—is only of minor importance. On the other hand, the load factor and the system of transmission are of paramount importance when considering the transmission of electrical energy. The following figures for a distance of 25 miles make this point clear:

Cost of Conveyance by Rail of Coal, Coke, and Fuel Oil.

Distance, 25 miles.

Coal and Coke, per Ton.	Oil, per Ton.	Coal, per Therm.	Coke, per Therm.	Oil, per Therm.
s. d.	s. d.	d.	d.	d.
3 6	8 9	0·139	0·150	0·246

Cost of Transmission of Gas.

(Calorific Value 500 B.Th.U., 60° F., and 30 in. satd.).

Distance, 25 miles.

Quantity per Day, C.Ft.	5 Million.	25 Million	50 Million.
Equivalent therms per day	25,000	125,000	250,000
Pence per therm	0·400	0·256	0·206

Cost of Transmission of Electricity.

System	Overhead at 132,000 Volts.			Underground at 66,000 Volts.		
Quantity	100,000 KW.			100,000 KW.		
Equivalent therms	3,412			3,412		
Load factor %	100	50	25	100	50	25
Pence per therm	0·492	0·797	1·45	1·15	2·03	3·89

In the Fuel Conference paper referred to these figures were used to determine at what critical distance it becomes cheaper to rail coal than to transmit gas and transport coke separately. It was concluded that in the case of quantities of gas up to 5 million c.ft. per day it is cheaper to convey gas and coke over distances up to 5 miles than to rail coal for gas-making purposes. For quantities of

* Koopman. "Utilization of Coke Oven Gas," J. Inst. Fuel, 1934. Vol. 7, p. 245. ("GAS JOURNAL," Vol. 206, p. 457.)

† Smith. Transmission over various distances of energy, &c. Trans. of World Power Conference, London, 1928. Vol. 3, p. 828. ("GAS JOURNAL," Vol. 184, p. 125.)

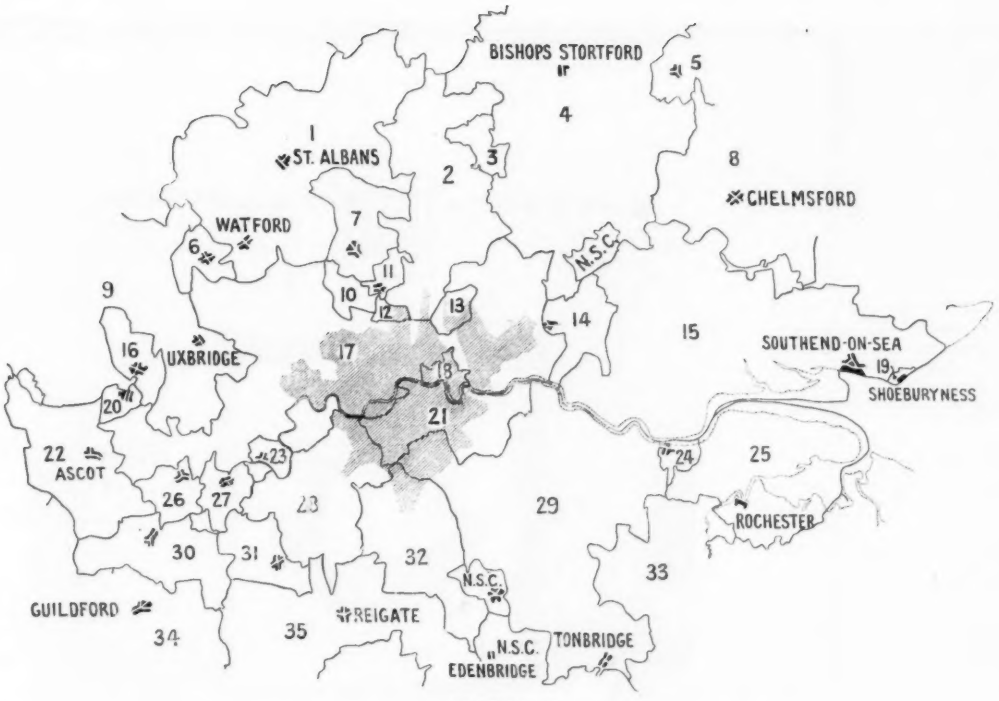


DIAGRAM I.

STATUTORY GAS SUPPLY AREAS OF THE LONDON DISTRICT.

1. Watford Company.
2. Tottenham and District Company.
3. St. Margarets Company.
4. Bishop's Stortford Company.
5. Dunmow Company.
6. Rickmansworth U.D.C.
7. Barnet Company.
8. Chelmsford Company.
9. Uxbridge Company.
10. North Middlesex Company.
11. Southgate and District Company.
12. Hornsey Company.
13. Lea Bridge District Company.
14. Romford Company.
15. Gas Light and Coke Company.
16. Slough Company.
17. Gas Light and Coke Company.
18. Commercial Company.
19. Southend-on-Sea Corporation.
20. Windsor Company.
21. South Metropolitan Company.
22. Ascot Company.
23. Hampton Court Company.
24. Gravesend Company.
25. Rochester Company.
26. Chertsey Company.
27. Walton-on-Thames Company.
28. Wandsworth and District Company.
29. South Suburban Company.
30. Woking Company.
31. Leatherhead Company.
32. Croydon Company.
33. Mid-Kent Company.
34. Guildford Company.
35. East Surrey Company.

N.S.C. Denotes a Non-Statutory Company.

gas of the order of 25 million c.ft. per day, the corresponding economic distance is about 35 miles, while for large quantities of gas, of the order of 50 millions per day, the distance becomes 100 miles and beyond.

This work has been extended to see what the effect would be if complete gasification of the coal were undertaken and the transport of coke thereby eliminated. In this case, as the calorific value of the gas would be only some 70 to 80% of that of normal town gas the quantity of gas requiring to be transmitted to give the same thermal delivery would be proportionately increased. Further, the specific gravity of the gas would be increased by about 20%. The effect of the greater volume and specific gravity is to increase the cost of gas transmission for a given thermal delivery.

The calculations show that with the elimination of coke transport by the adoption of complete gasification, the extra cost of transmitting gas only requires a greater saving per ton of coal in the cost of manufacture of gas than is the case if both gas and coke are transmitted. In other words, the economic distances mentioned above are reduced rather than increased.

The whole investigation supports the view that important economies in cost of gas manufacture when distribution is taken into account cannot be expected by concentration of manufacture at a few super-gas stations. Rather, it is indicated that centralization of manufacture in efficiently operated, medium-sized stations situated probably of the order of 20 miles apart is as far as this procedure can be carried economically. This view holds even if the production of coke by the Gas Industry were abandoned.

EXTENDED APPLICATIONS OF DISTANCE TRANSMISSION.

In the previous section of this paper, the limitations to the distances over which gas and coke can be economically transported, which the basic conditions of gas manufacture and distribution impose, have been discussed.

These limitations are naturally subject to local conditions. In areas which are only sparsely populated they are most severe. In more populous districts the conditions are less restrictive, since in addition to the large demand for gas for domestic purposes there is generally a considerable demand from industry. There are several such regions in different parts of Great Britain. One may mention the following: London, Birmingham, Lancashire, Yorkshire, Newcastle, and Glasgow.

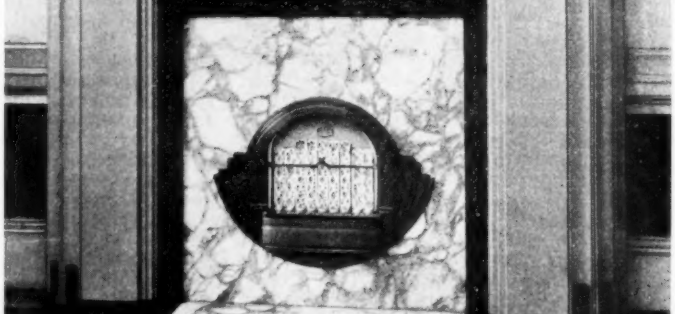
While recognizing that there are many important factors to be taken into account which can be correctly evaluated only by intensive and detailed study, the authors have been bold enough to call attention in the succeeding sections of the paper to three districts as being suitable for development along the lines of further co-ordination of manufacture and distribution of gas.

They are encouraged in this procedure, since it can be observed that in the examples of existing gas distribution systems described earlier in this paper both coke and gas are transported over distances substantially the same as those which the authors have in mind for other districts. Their suggestions, therefore, are in the nature of an extension of what is existing practice rather than of the introduction of any new principle.

London Area.

For the purposes of this paper an area bounded by Bishop's Stortford in the north and Reigate in the south, and running from the mouth of the Thames in the east to Ascot in the west has been chosen (Diagram I.). The river cuts the area into two zones which are, roughly, 20 miles wide at the widest part. There are 35 statutory areas in this region, the boundaries of which are shown in the diagram, which supply a population of 8,600,000 with 96,000 million c.ft. of gas per annum. They are, with the exception of three small undertakings, under company control. The prices at which gas is sold to ordinary consumers range from 8d. to 1s. 5d. per therm.

While situated at some considerable distance from the coalfields whence good gas coals can be obtained, those undertakings bordering the river have the advantage of cheap sea coast transport from Durham. They are enabled to obtain coals some shillings cheaper than those which may be only a few miles away, but which have no



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direct access to the river. Many of these undertakings depend either entirely or to a large extent on South Yorkshire coals.

The centralization which has already taken place on the north bank of the river is described in another section of this paper, but a glance at the diagram will show that this has not reached its logical conclusion. Areas belonging to other undertakings which are less remote than some already supplied from the centralized system of supply have not yet been linked up. On the south of the river, little progress has been made in this direction. A relatively small quantity of gas is made in area 21 and is sent into area 29. The problem resolves itself into a study of how far the manufacture of gas and coke can be economically concentrated at stations along the river which can receive water-borne coals.

It would appear that the logical trend would be to develop the gas-works already in existence on the Thames and to concentrate the remaining manufacturing stations on lines about 20 miles north and south of the river with the extreme western end of the area, supplied partly from the works on the river at the highest point where sea-borne coal can be obtained and partly by a works situated in area 22.

Birmingham District.

In giving consideration to the possibility of co-ordination of gas supply, attention might be given to the district within 20 miles of Birmingham (Diagram II.).

The characteristics of this area as they affect the question of gas supplies may be briefly summarized. The Birmingham gas supply area (the third largest undertaking in the country) occupies the centre. To the north, west, and south lie a series of townships, many of which are substantially of an industrial nature, while the remainder are residential. In the north-west section lies the important industrial district of the "Black Country."

In contradistinction to other densely populated parts of the country (excepting London) practically the whole of the coal used for gas-making is drawn from districts outside the area, largely from South Yorkshire, and Derbyshire, with smaller quantities from North Staffordshire and North Wales.

Taking the area within the dotted line, which covers 240 square miles with a density of population of about 8,000 per sq. mile, there are 11 separate gas undertakings ranging in annual sales from 80 million c.ft. to 13,936 million c.ft., the total annual gas sales being 18,024 millions. The present gas consumption per consumer is the high one for so large an area of 41,000 c.ft. per annum. The industrial load is one of the highest in the country.

The eleven undertakings could be linked up by a grid having a total length of about 37 miles if each district is to be able to receive gas from two directions.

Assuming that two centres of gas manufacture only were retained—in the Wolverhampton and Birmingham areas respectively—the ring main would handle 3,000 million c.ft. per annum required by the other 9 undertakings.

The cost of distribution of this quantity of gas would not exceed 2d. to 2½d. per 1,000 c.ft. of gas distributed, or, say, ½d. per therm, though on the total gas supplied by the undertaking the cost would be only 0·33d. to 0·42d. per 1,000 c.ft.

The amount of coke which would require to be railed into the districts would amount to 79,000 tons, and assuming an average railhaul of 5 miles, the extra cost would not be greater than the equivalent of ¼d. per 1,000 c.ft. Against these two items, however, must be set savings due to concentration of manufacture at two large stations. In the first place, there would be some saving in rail freight for coal, since the two manufacturing stations would be located in the Birmingham and Wolverhampton areas, which are the nearest points to the coalfields from which supplies are drawn. This saving may be expected to neutralize any extra cost incurred in railing coke from manufacturing stations to the centres of supply. Other savings in manufacture would undoubtedly more than neutralize the cost of distribution of the gas.

Lancashire Area.

The area to which attention has been paid is that lying between Preston and Colne in the north and between Liverpool and Stalybridge in the south; and from the eastern county boundary to the sea coast. This area includes a population of over 4½ millions, the sales of gas being about 32,000 million c.ft. per annum.

There are 53 statutory gas authorities in this area, of which 36 are owned by municipal authorities which are responsible for 70% of the gas sales. They range in size from very small concerns making less than 20 million c.ft. of gas per year to large ones producing nearly 8,000 million c.ft. in the year. There is an important industrial load in the south-east and easterly section of the area. This portion of the area is one of the most densely populated districts in the country, the triangle Manchester, Wigan, Rochdale being almost continuously built up.

The feature which differentiates this area from the other two already dealt with is the presence within the area of an important coalfield which supplies the major proportion of gas-making coals used. This fact tends to react unfavourably on the sale of gas and coke, since the same collieries produce house coal which can be sold relatively cheaply in the vicinity of the collieries. The population to some extent being employed by the collieries, the presence of "miners' coal" also is an adverse factor.

Nevertheless, on viewing the possibilities of co-ordinated gas supply, it will be readily appreciated that there is considerable scope for such development. For example, between St. Helens and Bolton, a distance of 27 miles, there are 8 manufacturing undertakings, or one for every 3 to 4 miles. There appears to be little doubt that a pipeline connecting these two places with a centralized manufacturing station placed at the centre of the coalfield so laid out as to be able to take full advantage of the classes of coal available and producing various types of coke most suitable for the needs of the area would be quite an economical development.

DIAGRAM II.

STATUTORY GAS SUPPLY AREAS OF THE BIRMINGHAM DISTRICT.

1. Cannock Company.
2. Lichfield Company.
3. Wolverhampton Company.
4. Willenhall Company.
5. Walsall Corporation.
6. Tamworth Company.
7. Birmingham Corporation.
8. Bilston Company.
9. Sedgley U.D.C.
10. Tipton U.D.C.
11. West Bromwich Corporation.
12. Dudley Company.
13. Rowley Regis Company.
14. Oldbury U.D.C.
15. Smethwick Corporation
16. Cradley Heath Company (N.S.C.)
17. Stourbridge Corporation.
18. Halesowen Company.
19. Solihull Company.
20. Kidderminster Company.
21. Bromsgrove Company.
22. Redditch Company.

N.S.C.—Denotes a Non-Statutory Company.

Another area where distribution of gas from a centralized station could be applied is the Rochdale-Bolton-Manchester triangle. A third pipeline in the Blackburn-Colne area is a possibility. This line would receive the gas from the coke ovens in the Accrington vicinity.

Finally, Manchester is already receiving a considerable part of its supplies from its own centralized works some

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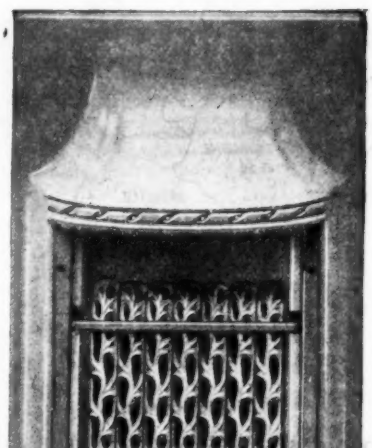

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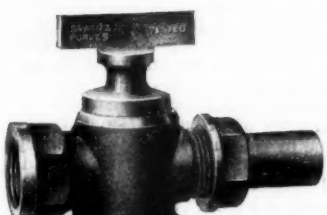

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13 miles from the city, and there is no question but what this is susceptible to considerable expansion.

FACTORS CONTROLLING PRICE.

The primary concern of the Gas Industry should be to produce cheap gas. It is not necessary that it should be as cheap thermally as coal or coke, the other advantages of gaseous fuel neutralizing to a large extent a higher cost.

There are many directions in which gas can be applied, but where to-day it is a luxury. It must not be forgotten, however, that the luxury of to-day may become the necessity of to-morrow. The extent to which the price of gas can be reduced will largely control the rate at which it changes from a luxury to a necessity.

In making a broad survey of this subject, it is important clearly to understand what are the factors that control the price of gas to the consumer. These can be broadly indicated as being:

1. The Cost of Coal. This depends very largely on the proximity of the manufacturing station to the source of supply or its proximity to convenient railways or waterways. It is interesting to note that in one highly industrialized area in the North of England over 1,000 square miles in extent there are works which are far from modern, but which could deliver gas to other towns 20 miles away, having the most modern equipment, at a cheaper rate than the gas can be made at the latter works. This is due to proximity to collieries and to easy access to railways.
2. Another factor of lesser moment, but nevertheless important, is that of local markets. If there is a big demand for coke in a given area, or for road tar, it is better to produce gas in that area, and so cut out distribution costs of coke, than to produce it in another area from which coke has to be exported in bulk.
3. Another factor is that of the modernization of manufacturing equipment. Carbonization and bye-product recovery, carried out on modern lines, can be operated under better financial conditions than was possible some years ago. The difference between the old and the new conditions may amount to as much as 1d. per therm.

The question of the size of works does not loom so large as in the electrical industry. The mere fact of size has little bearing on the cost of production of gas. Location, markets, and distribution are much more influential factors.

One important advantage that the Gas Industry has over the electrical industry is the fact that gas can be stored in holders. A temporary breakdown or irregularity in the working of a manufacturing plant is not felt by the consumer. It is therefore not necessary to carry duplicate or triplicate plants to provide against such eventualities. Most gas undertakings work up to 90% of their capacity at certain periods of the year, and rarely have more than a 50% margin in the summer months. This is reflected in the capital expenditure per unit of heat sold in the gas and electrical industries, it being in the proportion 1 to 8.

If the electrical industry were to displace gas generally for domestic purposes, the load factor of the electrical industry would be so seriously affected that the cost of electricity would materially rise and become even more prohibitive than it is for such purposes. On this count alone there is no likelihood of a radical change over.

4. The most important factor governing the cost of gas to the consumer is that of distribution. The cost of production of gas is rarely more than one-third of the selling price to the consumer. It is therefore all the more important that gas undertakings should not continue to be run as individual entities completely dissociated from one another.

There has been a move during the last year or two to correct to some extent this defect. Holding companies have come into existence which have acquired groups of undertakings, and this continues to take place. The primary incentive for most of these acquisitions has been the desire for investment of idle capital with a high degree of security. Such aggregations of gas undertakings will prove of national importance just in so far as the facilities provided are used to the greatest advantage. One fears a development of this kind because, although it is the first step in the right direction, it would not appear to have been taken as a result of a thoroughly considered national policy. Common control of undertakings makes it much more possible to bring about co-operative work and co-ordinated results than independent control, but so far no evidence has been forthcoming that this acquisition, for financial reasons, is any more than an end in itself.

The authors feel that the Industry is of such national importance that it should not continue to develop on these haphazard lines, with the main incentive for major changes coming from outside financial interests. There is no reason why the Industry itself, if given sufficient powers, should not develop a national scheme, probably dividing the country up into convenient zones, five or six in number, each of which should be under the broad control of a centralized authority, and all of whom would be linked up with some national body. The chief deterrent in this connection, in the author's view, is the incidence of municipally owned undertakings. These may be, and often are, as efficiently run as company undertakings, but the difficulties of bringing about financial and engineering co-operation between municipalities and others are almost insuperable.

No apology is made for bringing this matter before the Engineering Section of the British Association. While a comprehensive treatise on the subject has not been attempted, it is felt that sufficient material has been put forward to justify a much more detailed study of the subject, either by a Committee of the Association, a Committee of the Gas Industry, or even by some body brought into being by a Government Department.

[The discussion on this Paper is unavoidably held over till next week.]

Gas Undertakings' Results

Aberdeen.

Aberdeen Gas Department reports a revenue of £237,428 and an expenditure of £190,347, showing a balance of £47,081, which is carried to the net revenue account as compared with £56,254 for the previous year. The revenue shows a decline of £10,906 and expenditure is decreased by £1,733. The assets of the department are £932,602, and liabilities are £405,171, leaving a surplus of £527,431, an increase of £26,083.

Cleveland.

The annual report and statement of accounts of the Cleveland Gas Company for the half-year ended June 30, 1934, states that the profit made amounted to £542, to which is added the sum of £4,436, which was carried forward from the previous half-year, making a total balance at the credit of the profit and loss account of £4,978. The Directors recommend the payment of a dividend of 2½% per annum, less income-tax, for the half-year, which leaves £4,480 to be carried forward to the next half-year's account. The gas sold amounted to 12,474,200 c.ft., or 57,381 therms, and £551 was realized on residuals.

Cork.

The annual report of the Cork Gas Consumers' Company for the half-year ended June 30, 1934, states that after placing £1,527 to the credit of the depreciation fund, the balance of profit and loss is £4,459, with which the Directors propose to pay a dividend at the rate of 8% per annum.

Huntly.

Mr. James Ewen, Chairman of Huntly Gas Company, Ltd., presided at the 29th annual general meeting of shareholders and submitted the report, which showed a profit of £1,346. This sum, added to last year's balance of £3,115, made a total of £4,461. A sum of £567 has been written off for depreciation of plant, building, gas cookers, and fittings, leaving a balance of £3,894 at the credit of the profit and loss account. The Directors recommended the payment of a dividend of 10% per annum, free of income-tax, and that the balance of £3,494, subject to Directors' remuneration, be carried to next year's account.

Taunton.

Increased profits were reported at the 89th annual meeting of Taunton Gas Light and Coke Company, held on Aug. 23. The profit on the year's trading amounted to £8,264, about £200 higher than the previous year's figures. The meeting adopted the Directors' recommendation to declare dividends for the year ended June 30, 1934, at the following rates: 5% on the preferential stock, 7% on the redeemable preference stock, 9% on the consolidated "A" stock, and 7½% on the yellow shares, and on the new ordinary stock. It was stated 214,812,680 c.ft. of gas had been sold during the year. The Company had taken advantage of the Gas Undertakings Act, 1934, to give a special rate of 7½d. per therm for continuous domestic water heating.

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Gas Markets and Manufactures

Stock Market Report.

[For Stock and Share List, see later page.]

The feature of Stock Exchange business last week was the heavy buying of British Government stocks, particularly the 3½% War Loan, which at one time touched a new record level at 105⅛, easing to 105 at the close. A continuance of favourable traffic returns gave a fillip to Home rails, while interest in Industrials was well maintained; cable, tobacco, and motor shares all showing appreciations on the week.

Though business in the Gas market was not on a large scale, prices remained firm, and under the influence of the gilt-edged section a number of preference and debenture stocks appreciated in value. Brighton 6% "B" preference recorded the highest increase with a gain of 4 to 144½; Gas Light 4% preference and the three debenture stocks all hardened 1; and South Metropolitan 5% redeemable debenture was moved up 2 to 116½. Several stocks appreciated on the Provincial Exchanges, including Derby and Sheffield ordinaries, both with gains of 2 to 179½ and 140 respectively, while South Shields consolidated advanced 3 to 168. A parcel of the latter stock is on offer in London at 170, at which price the yield is 5%. The only set-back was in Newcastle units, which dropped 3d. on the local Exchange to 25s. 7½d., and here again the price quoted for a parcel of 248 units on offer in London is higher at 26s. 3d., giving a return of £4 2s.%

At the time of writing the list of debenture stocks available includes several not as a rule readily obtainable, some of which give a return of over 4%. Among these are the following: £180 Bristol 4% new at 104 yielding £3 17s., £260 British 4% at 102 yielding £3 18s. 5d., £400 Gravesend 5% at 122 giving a return of £4 2s., £200 Romford 4% at 101½ yielding £3 18s. 9d., and £50 Swindon 5% at 120 yielding £4 3s. 4d.%.

The South Eastern Gas Corporation is maintaining the interim dividend on the ordinary shares at 3%, payable on Oct. 1. The current price of these shares at 28s. 6d. still includes the full interim dividend and yields £4 4s. 2d.%.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *Sept.* 10.

There is little of interest to report in the tar products market with current prices at the following levels:

Pitch, about 57s. 6d. per ton f.o.b., with very little business passing.

Creosote, 4d. to 4¼d. per gallon.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole, about 2s. 2d.; pure benzole, 1s. 9d. to 1s. 10d.; 95/160 solvent naphtha, about 1s. 7d.; and 90/160 pyridine, 7s. to 7s. 6d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Sept. 10.

The average prices of gas-works products during the week were: Gas-works tar, 25s. to 30s.; Pitch—East Coast, 55s. to 57s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 55s. to 57s. 6d.* Toluole, naked, North, 1s. 8d. to 1s. 10d. Coal-tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, North, 9¾d. to 10¾d. Creosote, *ex* works, in bulk, North, liquid and salty, 3½d. to 3¼d.; low gravity, 3d. to 3½d.; Scotland, 3d. to 3¼d. Heavy oils, in bulk, North, 3¾d. to 4¼d. Carbolic acid, 60's, 1s. 10d. to 1s. 11d. Naphthalene, £10 to £11. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Sept.* 8.

Stocks at makers' works are not excessive and quotations are steady accordingly. A small but regular business is being conducted in all departments.

Crude gas-works tar.—Actual value is 33s. to 35s. per ton *ex* works in bulk.

Pitch.—New business is still difficult, although it is expected that the position will improve shortly. Meantime value for export is round 45s. per ton f.o.b. Glasgow and for home trade 42s. 6d. per ton *ex* works in bulk.

Refined tar.—Value is unchanged at 3d. to 3¼d. per gallon in buyers' packages at makers' works.

Creosote oil.—Available supplies find a fairly steady outlet in the home market and prices continue steady. B.E.S.A. Specification oil is 4d. to 4¼d. per gallon; low gravity, 4½d. to 4¾d. per gallon; and neutral oil, 4¼d. to 4½d. per gallon; all f.o.r. in bulk.

Cresylic acid.—A small but steady business is being conducted in all grades. Pale, 97/99%, is 1s. 3d. to 1s. 4d. per gallon; dark, 97/99%, 1s. 0½d. to 1s. 1¼d. per gallon; and pale, 99/100%, 1s. 4½d. to 1s. 5½d. per gallon; all *ex* works.

Crude naphtha commands 4½d. to 5d. per gallon according to quality.

Solvent naphtha.—90/160 grade is 1s. 3d. to 1s. 4d. per gallon, and 90/190 grade 8d. per gallon.

Motor benzole.—Value is nominal at 1s. 5d. per gallon.

Pyridines.—90/160 grade is 6s. 6d. to 7s. per gallon, and 90/140 grade 7s. to 8s. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

		s.	d.		s.	d.			
Crude benzole		0	9	to	0	9½	per gallon at works		
Motor	,,	1	3½	,,	1	4	,,	,,	,,
90%	,,	1	4	,,	1	4½	,,	,,	,,
Pure	,,	1	7½	,,	1	8	,,	,,	,,

Trade Notes.

Wholesale Fittings Company, Ltd.

Messrs. Wholesale Fittings Company, Ltd., will open their new branch at 142, King Street, Hammersmith, on Sept. 20. Telephone: Riverside 4940.

Waterless Holders for Cardiff.

We learn from Dry Gasholders, Ltd., that one of their Licensees, Messrs. Horseley Bridge & Thomas Piggott, Ltd., of Tipton, Staffs., have secured further orders from the British (Guest Keen Baldwins) Iron and Steel Company for Klönne waterless gasholders, one of 3,000,000 c.ft. capacity and one of 1,000,000 c.ft. capacity. These orders follow on the successful completion of a 2,000,000 c.ft. Klönne waterless gasholder erected by the Horseley Company for the British (Guest Keen Baldwins) Iron and Steel Company at Port Talbot. The two new holders are for the British (Guest Keen Baldwins) Iron and Steel Company's Steelworks at Cardiff, and form an important addition to the list of about 60 Klönne waterless holders already in commission in all parts of the world.

Overseas Opportunities.

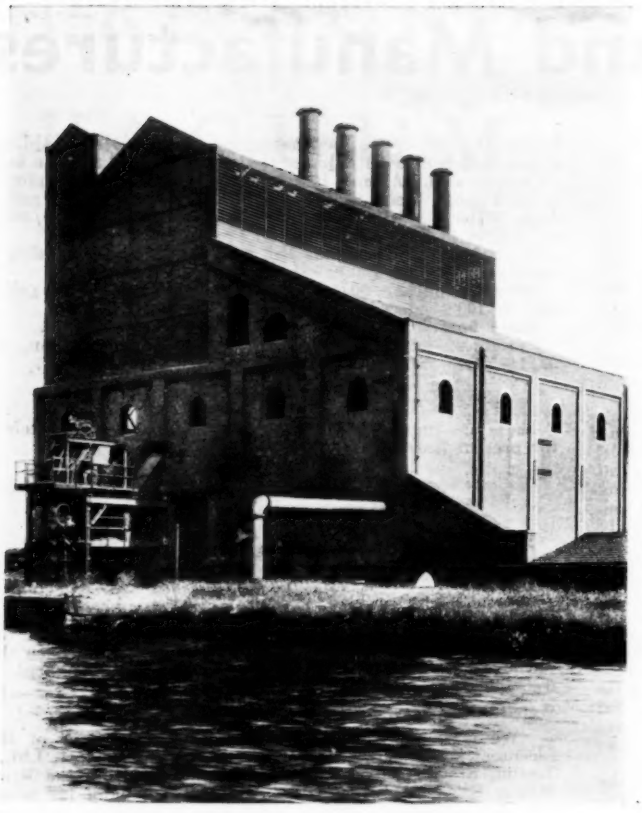
GAS-WORKS PLANT EXTENSION AT JOHANNESBURG.

H.M. Trade Commissioner at Johannesburg reports that the Johannesburg City Council are calling for tenders, to be presented in Johannesburg by Oct. 25, 1934, for the supply of gas-works plant in connection with an extension to the existing retort, capable of carbonizing 100 tons of coal per day.

Firms desirous of offering plant of United Kingdom manufacture can obtain the further details of this call for tenders upon application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W. 1. Reference number A.Y. 12616 should be quoted.

The Year's Work at Middlesbrough.

The annual report of the Middlesbrough Gas Department for the year ended March 31, 1934, states that in respect of the gross capital expenditure during the year of £13,172 an amount of £6,418 was met by borrowing and a sum of £4,185 provided by contributions from the net revenue account. The balance of £2,569 was met out of cash balances pending receipt from the Ministry of Health of the necessary sanction to borrow. The debt outstanding at March 31, 1934, amounted to £193,145 as compared with £210,452 at the same date last year, a decrease of £17,307. The gross profit was £41,331, as against £43,413 for the previous year. The income from the sale of gas amounted to £121,238, as against £123,553 for the previous year, a decrease of £2,314. This loss of revenue was due to the introduction of a sliding scale of charges for domestic supplies and special contract rates for large consumers after the June quarter, 1933. In addition more consumers took advantage of the discount, which increased by £643. A heavier reduction in revenue would have resulted had not the volume of gas sold increased as compared with the previous year by 8,645,900 c.ft. The gas purchased and manufactured during the year under review was 1,153,917,000 c.ft. Hire purchase and miscellaneous receipts increased by £935 from £14,144, to £15,079. The total revenue of the undertaking thus showed a decrease of £1,379. The expenditure for the year was £94,986 as compared with £94,283 for the previous year, an increase of £703. The gross profit for the year, amounting to £41,331, has been transferred from the revenue account.



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Falkirk adopted continuous carbonization on the Glover-West System in 1921, and the plant of forty vertical retorts illustrated above has supplied the gas requirements of the burgh continuously since that year. The new unit will have eight retorts of the steaming model, with an estimated daily gasmaking capacity of 720,000 cubic feet. There are now more than 350 installations of Glover-West vertical retorts in service or on order, with an estimated total daily output of 520 million cubic feet of gas.

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VERTICAL RETORTS

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CARBONIZING CHAMBERS

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WITH AUTOMATIC LUBRICATION

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CONVEYORS AND
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PLANT, ETC.

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WEST'S GAS IMPROVEMENT CO., LTD.

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MILES PLATTING, MANCHESTER 10

TELEGRAMS :
STOKER, MANCHESTER

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. Sept. 7.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Apl. 9	7	7	Alliance & Dublin Ord. ...	135—145	...	...
374,000	,,	June 25	4	4	Do. 4 p.c. Deb. ...	90—100	...	...
557,655	,,	Aug. 13	7	7	Barnet Ord. 7 p.c.	165—170	...	...
300,000	1	May 7	1/4½	1/9½	Bombay, Ltd.	27/6—29/6	...	28/—28/9
178,480	Stk.	Aug. 13	9½	9½	Bournemouth sliding scale	212—217	..	..
550,050	,,	,,	7	7	Do. 7 p.c. max. ...	166—171	...	170—172
439,160	,,	,,	6	6	Do. 6 p.c. Pref. ...	140—145	...	...
50,000	,,	June 11	3	3	Do. 3 p.c. Deb. ...	78—83	...	...
262,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	103—108	...	...
335,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	122—127	...	...
357,900	,,	Aug. 13	7½	7½	Brighton, &c., 6 p.c. Con. ...	161—166	..	..
540,000	,,	,,	6½	6½	Do. 5 p.c. Con. ...	152—157	+2	154—154½
195,500	,,	,,	6	6	Do. 6 p.c. B. Pref.	142—147	+4	144—144½
1,487,500	,,	July 9	5	5	Bristol 5 p.c. max.	116—118*a*	...	...
120,420	,,	June 11	4	4	Do. 1st 4 p.c. Deb. ...	102—105*a*	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	102—105*a*	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	121—123*a*	...	...
845,000	,,	Apl. 9	7	8	British Ord.	158—163	...	...
100,000	,,	June 11	7	7	Do. 7 p.c. Pref.	154—159	...	...
350,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	104—109	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	98—103	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	107—112	...	...
160,000	,,	June 11	5	5	Cambridge 5 p.c. Deb. ...	115—120	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	2—4	...	...
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	4—6	...	...
150,000	Stk.	July 23	4½	4½	Do. 4½ p.c. Deb. ...	90—95	...	...
626,850	,,	July 23	6	6	Cardiff Con. Ord.	129—133	...	...
237,850	,,	June 11	5	5	Do. 5 p.c. Red. Deb.	108—108	...	...
157,150	,,	July 23	6½	5	Chester 5 p.c. Ord.	113—118*b*	...	...
98,936	1	May 7	2/-	2/-	Colombo, Ltd. Ord.	1⅞—1⅞	...	...
24,500	1	,,	1/4½	1/4½	Do. 7 p.c. Pref. ...	19/6—21/6	...	...
609,204	1	Mar. 19	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	19/6—21/6	...	...
296,053	1	,,	1/8'30	1/8'30	Do. 8 p.c. Pref.	23/6—25/6	...	...
1,775,005	Stk.	July 23	6½	5	Commercial Ord.	118—123	...	122
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. ...	83—88	...	87
286,344	,,	Aug. 13	5	5	Do. 5 p.c. Deb. ...	120—125	...	...
807,560	,,	Aug. 13	7	7	Croydon sliding scale ...	152—157	...	156—157
669,590	,,	,,	5	5	Do. max. div.	103—108	...	107
620,345	,,	June 25	5	5	Do. 5 p.c. Deb.... ...	119—124	...	...
542,270	,,	Aug. 13	10	7	Derby Con.	177—182*e*	+2	...
55,000	,,	June 25	4	4	Do. 4 p.c. Deb.	97—100*e*	...	...
209,000	,,	Aug. 13	5	5	East Hull Ord. 5 p.c. ...	108—112	...	...
181,625	,,	Aug. 13	6	6	East Surrey Ord. 5 p.c. ...	126—131	...	...
175,809	,,	June 11	5	5	Do. 5 p.c. Deb. ...	120—125	...	...
1,002,180	,,	Apl. 9	†5	†7	European, Ltd.	124—129	...	125½—127
19,343,763	,,	Aug. 13	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	26/6—27/-*f*	...	26/6—26/9
2,000,000	,,	...	3½	3½	Do. 3½ p.c. max. ...	87—90	...	89½
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	105—108	+1	106—107
6,109,497	,,	May 28	3	3	Do. 3 p.c. Con. Deb. ...	87—90	+1	88½—89
2,643,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	116—119	+1	117*e*—118½
2,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	114—117	+1	115½
970,466	,,	Aug. 13	6	6	Harrogate New Cons.	127—132	...	...
140,000	1	Apl. 23	1/7½	1/7½	Hongkong & China, Ltd. ...	1⅝—1⅝	...	...
313,200	Stk.	Aug. 13	5	5	Hornsey Con. 3½ p.c. ...	127—132	...	...
5,500,000	,,	May 28	10	14	Imperial Continental Cap.	205—215	...	206—207½
228,180	,,	July 23	3½	3½	Do. 3½ p.c. Red. Deb.	92—97	...	...
235,342	,,	Aug. 13	8½	8½	Lea Bridge 5 p.c. Ord. ...	165—172	...	...
2,167,410	,,	Aug. 13	6	6	Liverpool 5 p.c. Ord. ...	132—134*b*	...	...
945,500	,,	June 11	5	5	Do 5 p.c. Red. Pref. ...	101—111*b*	...	...
306,083	,,	July 16	4	4	Do. 4 p.c. Deb. ...	100½—102½*b*	...	...
165,786	,,	Aug. 27	10	8	Maidstone 5 p.c. Cap. ...	180—190*	...	...
56,176	,,	June 25	3	3	Do. 3 p.c. Deb. ...	71—76	...	...
75,000	,,	May 28	†10	†10	Malta & Mediterranean ...	200—210	...	...
392,000	—	Apl. 3	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	101—104	...	...
231,978	Stk.	Aug. 13	5	5	M. S. Utility "C." Cons. ...	111—116	...	114
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	97—102	...	99—101
360,075	,,	June 11	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
148,955	,,	,,	5	†5	Do. 5 p.c. Deb. ...	119—124	...	...
125,000	—	July 2	...	11/8	Do. 3½ p.c. Rd. Rg.Bds.	97—100	...	...
675,000	,,	May 28	†6	‡13	Montevideo, Ltd.	58—63	...	...
2,061,315	,,	Aug. 13	5½	5	Newcastle & Gateshead Con.	25/3—26/-*df*	—/3	...
582,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	102½—103½*d*	+2	...
776,706	,,	June 11	3½	3½	Do. 3½ p.c. Deb. ...	92½—93¾*d*	+2	...
277,285	,,	May 7	5	5	Do. 5 p.c. Deb. '48 ...	105—107*d*	...	...
274,000	,,	Aug. 13	5	5	Newport (Mon.) 5 p.c. max.	105—107*a*	...	...
304,940	,,	Aug. 13	7½	7½	North Middlesex 6 p.c. Con.	153—158	...	...
396,160	,,	Aug. 13	5	5	Northampton 5 p.c. max. ...	102—107	...	...
300,000	,,	May 7	†9	†7	Oriental, Ltd.	162—167	...	...
416,617	,,	June 11	8	8	Plym'th & Stonehouse 5 p.c.	177—182	...	179
504,416	,,	Aug. 13	8	8	Portsm'th Con. Stk. 4 p.c. Std	166—171	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	103—108	...	...
114,000	,,	July 23	5	5	Preston 5 p.c. Pref.	101—106	...	...
1,736,968	Stk.	Aug. 27	6	6	Sheffield Cons.	139—141*e*	+2	...
95,000	,,	July 9	4	4	Do. 4 p.c. Deb.	100—101*e*	...	...
133,201	,,	Aug. 13	5	8½	Shrewsbury 5 p.c. Ord. ...	137—142	...	...
90,000	10	May 28	‡4	‡3	South African	2—4	...	...
889,095	1	May 7	1/2½	1/2½	South East'n Gas Cn. Ld Ord	28/—29/-	+/3	29/-
736,061	1	Apl. 9	-/10½	-/10½	Do. 4½ p.c. Red.Cum.Pref	22/—23/-	+/3	22/6
450,000	Stk.	Aug. 13	74/1	4	Do. 4 p.c. Red. Deb. ...	101—103	+1	...
6,709,895	,,	Aug. 13	7	5	South Met. Ord.	135—138	..	136½—138½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	142—147	+1	..
850,000	,,	,,	4	4	Do. 4 p.c. Irred. Pf.	102—106	..	105
1,895,445	,,	June 25	3	3	Do. 3 p.c. Deb ...	84—87	..	..
1 000,000	,,	July 9	5	5	Do. 5 p.c. Red. Deb.	115—118	+2	117 - 117½
209,820	,,	Aug. 13	8½	8½	South Shields Con.	167—169*d*	+3	..
1,543,795	,,	July 9	6	6	South Suburban Ord. 5 p.c.	133—136	...	134½
512,825	,,	,,	5	5	Do. 5 p.c. Pref.	120—125	...	...
300,000	,,	,,	4	4	Do. 4 p.c. Pref.	101—106	...	...
868,837	,,	June 11	5	5	Do. 5 p.c. Deb.	121—126	...	124
100,000	,,	,,	4	4	Do. 4 p.c. Deb.	102—107	..	..
647,740	,,	Aug. 13	5	5	Southampt'n Ord. 5 p.c. max.	108—113	...	...
121,275	,,	June 11	4	4	Do. 4 p.c. Deb.	99—104	...	...
350,000	,,	Aug. 13	5½	5½	Swansea 5½ p.c. Red. Pref.	107—112	..	108½
200,000	,,	June 11	6½	6½	Do. 6½ p.c. Red. Deb.	100—105	...	...
1,076,490	,,	Aug. 13	6½	6½	Tottenham and District Ord.	153—158	...	...
409,835	,,	,,	5½	5½	Do. 5½ p.c. Pref. ..	125—130	...	...
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	113—118	...	...
199,005	,,	June 11	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
349,110	,,	Aug 13	7	7	Uxbridge, &c., 5 p.c. ...	153—158	...	157½—158
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	112—117	...	...
1,322,220	,,	Aug. 13	7	7	Wandsworth Consolidated	157—162	...	159—159½
1,096,373	,,	,,	5	5	Do. 5 p.c. Pref.	119—124	...	122½—123½
1,317,964	,,	June 11	5	5	Do. 5 p.c. Deb.	121—126	...	125—126
208,300	,,	,,	...	26/8	Do. 4 p.c. Deb.	104—107	...	...
158,400	,,	Aug 13	6*g*	5	Winchester W.& G. 5 p.c. Con.	115—120	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. *g.*—Paid £3, including 10s. on account of back dividends. * Ex. div. † Paid free of income-tax. ‡ For year.

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NEW ISSUE OF 4½% REDEEMABLE DEBENTURE STOCK (1954).

NOTICE is Hereby Given that it is the intention of the Directors of the above Company to OFFER FOR SALE BY TENDER such an amount of 4½% REDEEMABLE DEBENTURE STOCK (1954) as will not exceed, including Premiums, the sum of £7,695 9s. 8d., to be redeemed at par on 30th September, 1954.

Minimum price of issue, £105 per £100, yielding at that price £4 2s. 2d. per cent. per annum.

Prospectus and Form of Tender (which latter must be received at the Company's Offices, as under, by noon on Tuesday, the 18th September, 1934) may be obtained from the undersigned or from the COMPANY'S BANKERS, WESTMINSTER BANK, LTD., BOGNOR REGIS.

By Order of the Board of Directors,
FRANK G. WATSON,
Secretary.

Gas and Electricity Offices,
Argyle Road,
Bognor Regis,
Aug. 29, 1934.

COMPANY NOTICES.

BRITISH GAS LIGHT COMPANY, LTD.

NOTICE is Hereby Given that the TRANSFER BOOKS of the ORDINARY STOCK of this Company WILL BE CLOSED from the 15th to the 28th September, both days inclusive.

By order of the Court of Directors,
A. J. MUMFORD, Secretary.

Chief Office: No. 2, The Abbey Garden,
Westminster, S.W. 1,
Sept. 11, 1934.

OXIDE

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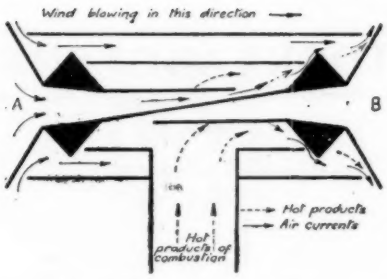

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